

Exhibit 1

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF NEW YORK**

**VILLAGE OF STILLWATER,
TOWN OF STILLWATER,
TOWN OF WATERFORD,
WATER COMMISSIONERS OF THE
TOWN OF WATERFORD,
VILLAGE OF WATERFORD,
TOWN OF HALFMOON and
COUNTY OF SARATOGA,**

Plaintiffs,

v.

GENERAL ELECTRIC COMPANY,

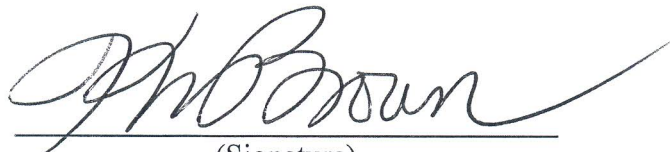
Defendant.

Case No. 1:09-cv-0228,
DNH-DRH,
consolidated with
Case No. 1:11-cv-006

EXPERT WITNESS REPORT

OF

KIRK WYE BROWN, PH.D.



(Signature)

September 13, 2013

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EXECUTIVE SUMMARY

At the request of counsel, I have reviewed the available information related to the release and transport of polychlorobiphenyl (“PCB”) and PCB containing waste oils generated by the General Electric Company (“GE”) into the Upper Hudson River. These releases included the direct discharge of PCB wastes through storm sewers and outfalls, among other routes, into the Hudson River and the release of PCBs from the contaminated sediments at GE’s Hudson Falls facility and GE’s Fort Edward facility into the Hudson River. These releases also included the discharge of PCB containing dense non-aqueous phase liquids (“DNAPL”) and groundwater containing dissolved PCBs from beneath both GE facilities into the Hudson River.

In a Record of Decision (“ROD”) issued on February 1, 2002, the United States Environmental Protection Agency (“EPA”) selected a remedy for the Hudson River site, which included the dredging of approximately 2.65 million cubic yards of PCB-contaminated sediments from the Upper Hudson River, including an estimated 75 tons of Total PCBs. In October 2005, GE executed a Consent Decree with EPA requiring GE to perform the scope of work for Phase 1 of the remedial action. The Consent Decree was modified in January 2009 to stipulate GE’s reimbursement of costs incurred by EPA in providing an alternate water supply and water treatment to downstream water suppliers during the remedial action.

As part of the 2002 ROD, EPA increased monitoring at public water systems that draw water from the Hudson River as a drinking water source as a way to prevent exposure to the consumers of the public water systems. The increased monitoring was further intended to evaluate the potential for increased PCB levels in the river water during the dredging of sediment. To mitigate exposure to PCBs, EPA developed a set of Engineering Performance Standards to promote accountability and ensure that the remedial actions meet the human health and environmental protection objectives set forth in the 2002 ROD. When the Engineering Performance Standards were met, namely the concentrations of PCBs in the water and the mass loading of PCBs in the river, then public water systems could continue to draw water from the river as a source of drinking water.

For periods when public water systems could no longer draw water from the river, EPA identified contingency measures for alternative sources of drinking water for the public water

systems, including the Town of Waterford and the Town of Halfmoon water supplies, as well as for the Village and Town of Stillwater. The contingency selected by EPA for the Towns of Waterford and Halfmoon was an alternative water supply connection to the water supply from the City of Troy, New York. The Saratoga County Water Authority elected to construct a new water line to draw water upstream of the PCB contamination and an alternate water supply connection from the Saratoga County Water Authority to the Village of Stillwater was constructed.

Due to the actual and threatened future release of PCBs into their water supply, the Waterford Water Commissioners, the Town and Village of Waterford, and the Town of Halfmoon, elected to discontinue using the Hudson River as a source of drinking water and obtain their drinking water from an alternative source, prior to the start of dredging. The Saratoga County Water Authority opted to locate its Hudson River water intake upstream of the GE plants and dredging in the river. The Village and Town of Stillwater, due to their well field water supply being contaminated by PCBs from the Hudson River, also sought an alternative source of water which is now purchased from the Saratoga County Water Authority.

Phase 1 of the dredging project demonstrated that GE did not meet the Engineering Performance Standards, designed for the protection of public health. Likewise, GE has failed to meet the revised performance standards at times during Phase 2 of the dredging project. As more fully expressed in my report, my opinions with respect to the impacts of PCBs on the Hudson River and the residents of Saratoga County residing along the Hudson River are as follows:

1. Polychlorobiphenyls, due to their chemical structure have a very long lifetime in the environment. Further, the International Agency for Research on Cancer has classified PCBs as human carcinogens. It is therefore my opinion, that any PCBs remaining in the river environment will impact all forms of life in the river ecosystem, including the inhabitants that live along the river, and those in the municipalities that rely on the Hudson River below Fort Edward as a source of water.
2. GE has failed to provide a mass balance calculation of the amount of PCBs that were released to the environment. Furthermore, the total mass of PCBs entering and continuing to enter the river has not been determined, and all of the potential sinks for PCBs along the river have yet to be identified. Additionally, the total mass of PCBs in each of the components of the river is unknown. Dredging has demonstrated higher mass loading and concentrations of PCBs in the water column downstream, however, the

locations of redeposited PCBs has not been identified. While it is not possible to accurately predict precise, future concentrations of PCBs in the water of the Hudson River at any particular location or time, it is my opinion that PCBs will be present and a threat to the plaintiff municipalities that use the Hudson River as a source of water.

3. Dredging in Phase 1 of the project has failed to remove all of the targeted mass of PCBs from the river for the dredged areas completed during Phase 1. Only one of the certification units, dredged in Phase 1 has successfully met the residual standard of 1 mg/kg TRI+ PCBs prior to closure. It is my opinion that even with re-dredging, it is unlikely that all of the certification units in Phase 2 will meet the residual standard for closure of the certification units.
4. It is my opinion that capping of residual PCBs in the closed certification units is only a temporary solution to the containment of residual PCBs. Resuspension of the river bottom sediments is inevitable and will result in the resuspension of PCBs in the water column and their transport downriver.
5. As demonstrated in Phase 1 of the project, concentrations of PCBs resuspended in the water column as a result of dredging in the Upper Hudson River vastly exceeded the acceptable load and concentration standards set by EPA and agreed to by GE. PCBs have been and continue to be resuspended and transported with the flow of water downstream, where they are redeposited in areas not planned for dredging. The locations of downstream deposition due to these releases are unpredictable due to fluctuations in the flow of the river. The quantity, concentration, and the effects of this deposition may not be fully understood for many years, if not decades, to come. However, it is known that increased PCB water column concentrations have been recorded downriver, including during the dredging offseason and particularly, during high flow events in the river. These elevated PCB concentrations are likely to continue through the end of dredging and after dredging is completed. Therefore it is my opinion that alternative water supplies were required for the communities during dredging and will be required long after dredging is completed to minimize further exposure to PCBs.
6. The ongoing transport of PCBs in the form of resuspended sediments, dissolution in the water column, and surface transport as oil sheens, or as transport with the bed load of sediment in the river bottom, has exceeded the dredging project's engineering performance standards in both Phase 1 and Phase 2. It is my opinion that since the mass of PCBs transported in surface sheens and the bed load has not been quantified and the placement of redeposited PCBs has not been identified, future impacts due to these PCBs or the timing of the impacts from these PCBs, cannot be predicted with any level of certainty to permit the plaintiff municipalities to utilize the Hudson River as a safe source of drinking water supply not threatened by PCBs.
7. In my opinion, a stationary monitoring location collecting a time-weighted average sample will not capture the maximum concentrations of resuspended PCBs in the water column. Therefore, it is my opinion that stationary monitoring will not be adequate for

predicting the concentrations of PCBs in the water at the intake to a public water supply with any level of surety.

8. The Engineering Performance Standards were designed to protect downstream public water supplies. By complying with the Engineering Performance Standards in Phase 1, EPA determined that the water from the Hudson River could be safely used as a source of water for the municipal water supplies. GE, however, was unable to consistently meet the Engineering Performance Standards during Phase 1. The revised Engineering Performance Standards developed for Phase 2 of the project have increased the allowable quantity of PCBs that can be released to the water column as a result of dredging, which poses an additional risk to the water supplies. It is my opinion that the higher mass loading and increased concentrations allowed under the Engineering Performance Standards in Phase 2, pose an additional risk to the water supplies of the plaintiff municipalities.
9. The well field for the Village of Stillwater is contaminated with PCBs with the same chemical signature as the PCBs in the Hudson River. In order to restore the well field for future use, it is my opinion that the PCBs in the aquifer materials of the Stillwater aquifer must be removed and the aquifer must be isolated from the river so that infiltration from the river cannot recontaminate the aquifer.
10. Due to the unknowns associated with ongoing sources of PCBs entering the river as well as the fate and transport of PCBs currently in the river, it is unrealistic to project the future concentrations of PCBs in the water column of the river with any certainty. Further, it is impossible to predict the future concentrations of PCBs in the water supply sources connected to the river or the long term consequences of PCBs on the residents of the communities along the Hudson River with any level of confidence. Therefore, it is my opinion that even with the ongoing remediation, the time required to return the PCB concentrations in the river to levels before the start of dredging could take decades if not longer.
11. It is my opinion that until all of the PCBs already in the river and the sources of PCBs still entering the river have been identified and removed, including those in the well field at Stillwater, an alternative water source that is proven and reliable, must be available to the Village of Stillwater and the Towns of Waterford and Halfmoon to protect against the risk of unacceptable amounts of PCBs threatening the water supplies.
12. In my professional opinion, the only viable solution to ensure safe drinking water for the residents of Stillwater, Waterford, Halfmoon, and Saratoga County, is to provide a permanent, alternate source of water supply.

In the river, dredging has and will remove PCBs from the river sediments. However some residual PCBs will remain after dredging, although it is unknown what total mass of PCBs will remain and where these PCBs will be located following dredging. It is known, however, that

PCBs continue to enter the river at the plant sites, although, the quantity and timeframe for release to the river cannot be predicted with confidence, based on the dynamics of the river. Despite GE's best efforts, sampling and monitoring of the Hudson River does not adequately characterize the concentrations of PCBs in the water across the entire span of the river, nor does this sampling and monitoring protect residents who may continue to use the water from the river as a source of drinking water. At any time, the water in the river is subject to a spike in PCB concentrations causing the water to be unfit for human consumption, especially during high flow events.

For these reasons, the plaintiff municipalities acted reasonably and responsibly to obtain alternate sources of drinking water in response to the releases and threatened future releases of PCBs to the water of the Hudson River. The response actions and associated costs to obtain an uncontaminated source of drinking water are consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR §300.5) and as stipulated under the Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §9601).

1.0 INTRODUCTION

I have been asked by counsel to review the site information and associated documents concerning the release of PCBs and PCB containing waste oils generated by the General Electric Company to the Hudson River at Fort Edward and Hudson Falls, New York. Specifically, I was asked to address the following topics:

- a. The impacts of the PCBs released by the General Electric Company facilities on the oils, sediments, channel, and river banks of the Hudson River;
- b. The impacts of the PCBs released by the General Electric Company facilities on the quality of water in the Hudson River;
- c. The impacts of the PCBs released by the General Electric Company facilities on the public water systems that rely on the water from the Hudson River as a source of drinking water; and
- d. The impacts of PCBs released by the General Electric Company facilities on the continuing exposure of residents of the communities along the Hudson River to PCBs.

I have reviewed the reports provided by counsel and gathered independently and offer my professional opinions in this report.

1.1 BACKGROUND/QUALIFICATIONS

From 1970 through 2001, I was employed as a Professor of Soil and Crop Sciences in the Soil and Crop Sciences Department, Texas A&M University, College Station, Texas. I currently serve as *Professor Emeritus* in the Soil and Crop Sciences Department, Texas A&M University, College Station, Texas. In 1990, I received a joint appointment to the faculty in Toxicology at Texas A&M University, where I supervised the research of masters degree and doctoral candidates in the field of toxicology. My educational background includes a Bachelor of Science degree in Agronomy from Delaware Valley College (1962), Masters of Science degree in Agronomy/Plant Physiology from Cornell University (1964), and Doctor of Philosophy degree from University of Nebraska (1969). My résumé is presented as Attachment 1, and includes a complete list of my publications.

While a member of the faculty at Texas A&M University, I conducted extensive research including numerous research projects for the U.S. Environmental Protection Agency and the National Institute of Health (“NIH”) on the fate and transport of contaminants, including pathways of exposure and toxicity of hazardous substances to receptors in the environment. As a result of these research efforts, I have authored or co-authored over 190 peer-reviewed, scientific publications, including numerous articles dealing with the disposal and treatment of waste materials, including Resource Conservation and Recovery Act (“RCRA”) hazardous wastes and Comprehensive Environmental Response, Compensation, and Liability Act (“CERCLA”) hazardous substances contained therein and the problems arising therefrom. Additionally, I have authored or co-authored over 35 publications which deal with risk assessment or toxicity of hazardous substances in the environment. I have conducted research in a national center funded by the EPA to study the fate of hazardous substances in the environment.

During my tenure at Texas A&M University, I taught courses in Soil Physics which included topics on the movement of air, water, and other fluids in the soil, and a graduate course on the land disposal of wastes, which included consideration of the principles and practices applicable to the fate, mobility, and clean-up of contaminated sites. Students in these classes included engineers, soil scientists, chemists, and geologists. I have served on hundreds of advanced degree committees in these and related disciplines.

I have served on technical advisory panels to the EPA, committees of the Office of Technical Assessment, and the National Academy of Science. Significant reports resulting from these committee assignments include, Groundwater and Soil Cleanup, Improving Management of Persistent Contaminants (1999); Ranking Hazardous Waste Sites (1994); Coming Clean, Superfund Problems Can be Solved (1989); and Superfund Strategy (1985). I was the primary author of a 1983 publication for the EPA entitled Hazardous Waste Land Treatment. This publication specifically addressed the treatment of hazardous wastes from industrial waste streams to mitigate risk during treatment and eliminate risk to potential receptors.

In 1981, I was appointed to the EPA Land Treatment Task Force where I served from 1981 through 1985. As part of my assignment with the Task Force, I evaluated the alternatives for land disposal of wastes and the risk associated with the disposal alternatives. While a member of this Task Force, I testified before the U.S. House of Representatives - Science and Technology

Committee in November 1982 on the adequacy of EPA's liquid management system to protect groundwater at hazardous waste landfills, which lead to the passage of the Hazardous and Solid Wastes Amendments of 1984 under the Resource Conservation and Recovery Act.

In 1983 and 1984, I was a member of the Advisory Panel to U.S. Congressional Office of Technology Assessment. This panel was tasked with determining the effectiveness of current EPA programs to clean up uncontrolled hazardous waste sites. As part of my assignment with this committee, I reviewed and evaluated the toxicity and imposed risk to receptors due to hazardous substances and provided recommendations for improving the efficiency of EPA programs to mitigate risk at uncontrolled hazardous waste sites.

In 1984, I was a member of the Office of Water Regulations and Standards Committee on Municipal Sludge Landfilling, which was formed to advise EPA on the pollutants which should be regulated for disposal and the methods or procedures to be used for regulating such pollutants. As part of my work for this committee, I assessed the hazards and risk associated with the hazardous substances contained in municipal sewage sludge and provided recommendations for regulation of metals in sewage sludge based on the degree of risk presented by exposure to these metals.

From 1987 through 1995, I was a member of the Advisory Panel to U.S. Congressional Office of Technology Assessment which was tasked with assessing the effectiveness of the EPA in identifying, prioritizing and cleaning up hazardous waste sites. As part of my work for this committee, I evaluated the impacts of exposure from different media and the effectiveness of available technologies to mitigate exposure and risk from hazardous waste sites.

From 1991 through 1994, I served on the National Academy of Sciences Committee on Remedial Action Priorities for Hazardous Waste Sites, where I evaluated the role of risk assessment and mitigation of risk in the decision process for remedial action.

From 1995 through 1998, I served on the National Academy of Sciences, National Research Council Committee on Environmental Technologies Subcommittee on Landfills. As part of my assignment to this committee, I evaluated the risk due to contaminants in soil and groundwater and recommended strategies for the management and control of recalcitrant wastes for the reduction of risk due to these persistent contaminants.

In addition, I have served on numerous EPA review panels addressing toxicity and risk including the following, among others:

- EPA Panel to Review the Acceptability of Landfill Disposal of Sewage Sludge (1984);
- EPA Panel to Write a Protocol for Mutagenicity Sample Preparation (1984);
- EPA Hazardous Waste Center Review Panel (1988); and
- EPA Review for Risk Assessment for Petroleum Industry Hazardous Waste Listing Determination (1995).

Additionally, I provided technical review as a member of peer review panels for the United States Department of Health and Human Services, Public Health Services for review of toxicological profiles for the Agency for Toxic Substances and Disease Registry (“ATSDR”) from 1990 through 2000.

I am personally familiar with the definition of “hazardous substance” as defined in § 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act and under the statutes and regulations incorporated by reference into that section. A hazardous substance under CERCLA is defined in 42 U.S.C. § 9601 (14), invoking the EPA designations under 42 U.S.C. § 3001 and 9602, among other statutes. Included in the definition of a CERCLA hazardous substance are certain hazardous wastes which are either listed in 40 C.F.R. § 261, Subpart D or have certain identified characteristics as described in 40 C.F.R. § 261, Subpart C. Likewise, I am familiar with the regulations defined in 40 CFR § 761 and the requirements specified for the disposal of PCBs as hazardous wastes contained in Subpart G of that chapter.

I have studied and am familiar with industrial, commercial, and residential waste, and the landfills that eventually contain such waste. I have researched the risks associated with leachate from landfills containing these wastes. I have also investigated the fate and behavior of organic compounds and metals found in leachate from landfills and the resulting impacts on the underlying groundwater. I have reviewed numerous remedial plans and proposed remedies pertaining to landfills containing industrial, commercial, and residential wastes.

I have studied and am familiar with the fate and transport of non-aqueous phase liquids (“NAPL”) including dense non-aqueous phase liquids in the environment. I have conducted extensive research on the movement of NAPLs through clay soils for EPA and substantial research on the partitioning of organic constituents between aqueous and non-aqueous phase liquids. I have studied the partitioning of PCBs into non-aqueous phase liquids associated with

the Delaware River at the Metal Bank of America Superfund Site in addition to the fate and transport of PCB containing oils in the mud flats and riverbanks of the Delaware River.

Further, I have designed and implemented numerous remedial response actions under RCRA. Many of these response actions were implemented consistent with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), including remedial projects for Exxon, Chevron, Koch Industries, Inc. and Marathon Oil.

I have been a consultant in the field of environmental science and engineering for the past 33 years. I founded K. W. Brown and Associates, Inc., and served as President from 1980 until 1991. I was employed as a Principal Consultant with K. W. Brown Environmental Services from 1991 until 1999 and with SI Group, LP from 2000 through 2008. In March 2009, I joined the firm of ThermoTech Intl. (TTI) and was employed as a Principal Consultant through April 2011. Since that time, I have been employed as an independent consultant.

Through these years of consulting, numerous private and public clients have employed me. My expertise has been utilized for site assessments, data review and interpretation, waste management activities, the study of fate and transport of contaminants in the environment, the movement of contaminants in groundwater and surface water, the design and implementation of remedial actions for recalcitrant organic compounds, and other related environmental matters. I have also reviewed and interpreted a large quantity of analytical data for soils and groundwater, as well as borings logs, field logs, technical reports, and other information related to the environmental conditions of a site.

As a consultant, I have evaluated or analyzed numerous waste disposal and landfill sites including the following: Laurel Park Landfill, Beacon Heights Landfill, Lone Pine Landfill, Ft. Bend County Landfill, Oak Grove Landfill, East Bethel Landfill, Dickson County Landfill, and Sinton Landfill, among others. In addition, I have also worked on the following Superfund sites: Hardage Criner, Love Canal Landfill, Lowrey Landfill, Montana Pole, National Gypsum, Riley Tar, Sharon Steel, Helen Kramer Landfill, Sikes' Pits, Metal Bank of America, Tar Creek, and the West Dallas Lead Site.

1.2 PRIOR EXPERT TESTIMONY

I have qualified and given testimony as an expert witness in civil cases in federal and state courts, regulatory hearings, and enforcement actions pertaining to hazardous wastes, organic chemical contamination, and the fate and transport of organic chemicals, NAPL, DNAPL, metals, and other contaminants in environmental media, as well as exposure and risk, among other issues. I have offered opinions related to these topics at several Superfund sites. A complete list of cases in which I have rendered opinions is presented in Attachment 2.

1.3 COMPENSATION

I am being compensated at my customary rate for work in this case. My hourly rate of compensation is \$300 per hour for non-testimony time and \$350 per hour for testimony time.

1.4 EXHIBITS

I may use as exhibits any document contained or referred to in this report, or supplements to this report, including but not limited to the appendices; any document needed as foundation for or illustration of my testimony; any document listed as an exhibit or provided in discovery by Defendants or any other party; any document considered by any of the Defendants' or any other party's experts; or any document needed to respond to or to rebut testimony on behalf of Defendants or any other party. I reserve the right to provide lists of exhibits as permitted by the Federal Rules of Civil Procedure and the Scheduling Orders in this case.

1.5 RESERVATION OF RIGHTS

I reserve the right to supplement or modify opinions expressed herein upon which I expect to testify, to add to or modify the bases and reasons for my opinions and supplement the exhibits that I may use at trial for any of the following reasons: (1) to respond to expert reports, including but not limited to rebuttal reports, conducted for Defendants or for any other party; (2) to respond to new information; (3) to respond to information obtained in discovery, including but not limited to depositions and interviews; and (4) as permitted by Rule 26 Fed. R. Civ. P.

2.0 DATA OR OTHER INFORMATION CONSIDERED

This report was developed as a result of discovery of data to which I have been provided access. The opinions I have formed in this case are based on my education and experience listed in Section 1.0, as well as the information cited for this report in Attachment 3.

3.0 BACKGROUND

The Hudson River PCBs Superfund Site includes the stretch of the Hudson River from the Fenimore Bridge in Hudson Falls to the Federal Dam at Troy (Upper Hudson River) and the stretch of the Hudson River extending from the Federal Dam at Troy to the Battery in New York Harbor (Lower Hudson River).

From approximately 1947 through 1977, PCB containing oils were disposed both directly and indirectly from the General Electric (GE) facilities at Hudson Falls and Fort Edward into the Hudson River (Malcolm Pirnie, 2004). As indicated in the Record of Decision, issued by the New York State Department of Environmental Conservation in 2004 for GE's Hudson Falls facility, these disposal activities have caused significant environmental damage by contamination of the aquifers beneath the site and the Hudson River by PCBs released from soils, sediments, and the bedrock aquifer at the site (NYSDEC, 2004). The estimated quantity of PCBs released from the two GE facilities was approximately 650 tons (1,300,000 pounds) (Malcolm Pirnie, 2004).

Historically, dense non-aqueous phase PCB-bearing oils (DNAPL) leached directly into the bedrock under Operations Building 1 of GE's Hudson Falls facility. Concurrently, PCBs migrated into the Hudson River from GE's Fort Edward facility through Outfall 004 and from the soil, sediment, and bedrock at the Fort Edward plant connected to Outfall 004. In their report, dated November 1976, Dames and Moore stated that "Some PCB contamination of the shallow aquifer has occurred at both plants with the greatest amounts observed at Fort Edward." As indicated by the results of the 1994 investigations conducted by Dames and Moore (1998), DNAPL was found to extend to the Hudson River. Further, DNAPL was found to have migrated downward through the shale unit (Snake Hill Shale) into the fractured zone of the upper portion of the underlying limestone unit (Glens Falls Limestone). The full extent of bedrock containing DNAPL and the associated aqueous phase plume of PCBs has not been defined either vertically or laterally. During the 1997 Remedial Investigation and Pilot Expansion studies, nearly 3000 gallons of DNAPL was collected from bedrock recovery wells and three types of DNAPL "fingerprints", old, new, and mixed DNAPL, were identified.

At this time, the existing DNAPL plumes continue to be sources of PCB contaminants to the Hudson River. The DNAPL and dissolved-phase PCB plumes under the GE sites and under Baker Falls have migrated down gradient to the southeast and currently extend downstream and beneath the Hudson River. The upward flow of groundwater from the underlying Glens Falls Limestone and Isle La Motte Limestone towards the Snake Hill Shale and the Hudson River has carried dissolved phase PCBs from the underlying DNAPL into the top layer of the aquifer and the Hudson River. As stated in the Record of Decision issued by New York State Department of Environmental Conservation (“NYSDEC”) that “in the Lower Snake Hill Shale the horizontal gradient is westerly toward the Hudson River; the vertical gradients are upward, as the groundwater is discharging to the Hudson River from below” (NYSDEC, 2004). The ROD also stated that “in the Glens Falls Limestone, the vertical gradient is also upward, but the horizontal flow gradient is to the south, down the axis of the Hudson River valley. This groundwater flow path, if uncontrolled, likely would result in groundwater discharge into the Hudson River some distance south of the site”.

Under the groundwater flow pattern described above, DNAPL and the dissolved phase PCB plume identified in the Snake Hill Shale is discharging into Hudson River west of both GE facilities (NYSDEC, 2004). DNAPL and the dissolved PCB plume tracked in the Glens Falls Limestone may be discharging into the Hudson River further downstream of the GE facilities (NYSDEC, 2004).

As stated in the ROD (EPA, 2002), “current and future concentrations of PCBs in the water column entering the Upper Hudson River are expected to limit the ability of remedial actions to achieve the stringent remediation goals for fish and some of the ARARs for the water column that have been identified for the Site”. Further, EPA has admitted that “Both the current and projected future combined upstream PCB load, although low, exceeds the New York State standard for protection of human consumers of fish, the New York State standard for protection of wildlife, and the federal Ambient Water Quality Criterion” (EPA, 2002).

Although operations involving PCBs at the GE facilities ceased in 1977, releases of PCBs to the Hudson River continue via transport of PCBs through the bedrock fractures beneath GE’s Hudson Falls facility (Malcolm Pirnie, 2004). Based on its reassessment of the site in 2002,

EPA required the removal of PCB contaminated sediment as a remedy for the Hudson River (EPA, 2002).

The 2002 Record of Decision for the Hudson River PCBs Site selected a remedy that included the “targeted environmental dredging of approximately 2.65 million cubic yards of PCB-contaminated sediment from the Upper Hudson River”, which included an estimated 150,000 lbs. of PCBs (EPA, 2002). Phase 1 of the dredging project began in April 2007 with the site preparation and construction of the Sediment Processing Facility. By January 2009, the Sediment Processing Facility along with the waterfront construction and construction of the rail yard were completed to start dredging operations. Phase 1 dredging operations, which began on May 15, 2009 and were completed on December 4, 2009, removed a total of 286,000 cubic yards (“cy”) of contaminated sediments. The actual dredged volume of sediments in Phase 1 exceeded the design volume of 265,000 cy even though the only 10 of the targeted 18 dredging areas were completed.

Field work for Phase 2 of the dredging project began in 2011 with the projected completion of the dredging project by the end of the 2016 dredging season (Malcolm Pirnie, 2004, Arcadis, 2013). For 2011, an estimated volume of 350,000 cy of sediment was targeted for removal from CU09 to CU30 (Arcadis, 2011). From the Final Design Report in 2012, the target removal objective was to dredge at least 350,000 cy of sediment from CU26 through CU49 during 2012 (Arcadis, 2012). The 2013 Final Design Report specified the removal of approximately 365,000 cy of contaminated sediments from CU49, CU55 through CU60, and CU67 through CU78 (Arcadis, 2013). The remainder of the certification units will be addressed in subsequent years with all capping and reconstruction activities to be complete by the end of 2016 (Arcadis, 2013).

The residents of Waterford, Stillwater, and other communities along the Upper Hudson River, have historically used water from the river or groundwater sources hydraulically connected to the river as source of drinking water. People using water from the river have been exposed to PCBs. To eliminate further exposure from PCBs, EPA mandated that GE develop “contingency measures for protection of the Waterford and Halfmoon municipal water supply systems, namely alternate drinking water supplies or additional treatment of drinking water” (EPA, 2009). EPA further directed GE, “to implement or fund the installation and maintenance

of a granular activated carbon system (GAC System") for the Village of Stillwater's water supply wells" (EPA, 2009), until such time as the Village constructed a pipeline to connect with the Saratoga Water Authority. With Consent Decree Modification No. 1, GE agreed to pay costs related to the provision of alternative water for the towns during dredging operations.

However, prior to the start of dredging, the Town of Waterford and the Town of Halfmoon decided to obtain their drinking water from the City of Troy, rather than continue to use water from the river, potentially causing additional exposure to PCBs. The Saratoga County Water Authority constructed its water intake upstream of the GE plants. The Village of Stillwater selected an alternate water supply through connection with the Saratoga County Water Authority as opposed to continued use of its well field contaminated by PCBs from the Hudson River.

During Phase 1 of the dredging project, GE was scheduled to conduct comprehensive sampling and monitoring for PCBs and other constituents on a daily basis during dredging activities at both near-field and far-field sampling stations. At far-field stations (Thompson Island, Schuylerville, and Waterford), daily composite samples, including two 12-hr composite samples at the Thompson Island monitoring station, were collected from automated samplers for PCB analysis (Parsons, 2009). Prior to the start of Phase 2, GE, in conjunction with EPA, extended the sampling period for the automated sample collectors to 24 hours per composite sample. As stated in the 2011 Community Health and Safety Program, "In the unlikely event that either of these Towns [Waterford and Halfmoon] is unable to obtain water supplies from the City of Troy and reverts to using Hudson River water for any period of time during 2011 dredging, procedures will be instituted during such period for conducting sampling over a shorter time frame (e.g., 12-hour samples) at the far-field stations in the Upper Hudson" (Parsons, 2011).

4.0 OPINIONS AND BASIS FOR OPINIONS

4.1 PCBs Longevity and Lifetime

OPINION: It is my opinion, that any PCBs remaining in the river environment will impact all forms of life in the river ecosystem, including the inhabitants that live along the river, and those in the municipalities that rely on the Hudson River below Fort Edward as a source of water.

BASIS OF OPINION:

Commercially, PCBs are mixtures of individual congeners, which were produced and marketed by Monsanto under the trade name Arochlor. Different series of arochlors were sold, differing by the percent chlorine content of the mixture. As a general trend, PCBs have relatively low solubility in water, and the solubility decreases with increasing chlorine composition (ATSDR, 2000). For example, Arochlor 1242, with 42% chlorine content has a water solubility of 0.24 mg/L, whereas Arochlor 1254, with 54% chlorine content and Arochlor 1260, with 60% chlorine content, have water solubilities of 0.012 mg/L and 0.0027 mg/L, respectively (Mackay et al., 1992; ATSDR, 2000).

In general, PCBs are recalcitrant organic compounds that exhibit long persistence in the environment and demonstrate a tendency to accumulate in soils, sediments, and biota. As a group, PCBs have large octanol-water partition coefficients (Log K_{ow} values ranging from 4.7 to greater than 6.8 for the more highly chlorinated arochlors) which cause them to accumulate and persist in soils, sediments, and particularly, oils (Mackay et al., 1992). When adsorbed to soils and sediments, PCBs undergo very little, if any, chemical or biological degradation. As stated by the ATSDR, “PCBs that remain firmly bound in soil and sediment may not be bioavailable to the degrading organisms” and “[B]elow a certain threshold concentration (<50 ppm), the rate of dechlorination is often very slow or non-quantifiable” (ATSDR, 2000). Degradation of PCBs when partitioned into non-aqueous phase oils is literally, non-existent due to the lack of interaction with dechlorinating microbes.

Mackay and his coworkers have estimated the mean half-life of the TRI+ PCBs in water and sediments to be greater than 9 years with much of the mass loss due to partitioning between environmental media (Mackay et al., 1992). The partitioning losses of PCBs from the Hudson River progress as follows. The PCBs held in the entrained oil and sediments partition into the

water of the river, while those in the water partition into the air as vapor. The vapor phase PCBs are physically removed from the atmosphere by wet and dry deposition as well as by vapor condensation on the surface of the water in the river (ATSDR, 2000). The cycling of PCBs between the atmosphere and terrestrial surfaces is a continual process throughout the Hudson River valley. PCBs freshly deposited from the air onto the surface soils and water, will be transported back into the river through natural, erosive processes.

PCBs have low vapor pressures, (estimated 5.0×10^{-3} torr to 6.0×10^{-5} torr) and low Henry's Law constants (2.0×10^{-3} atm•m³/mol to 3.0×10^{-4} atm•m³/mol), but still have the potential to volatilize from the surface of the water in the river (Monsanto, 1995; ATSDR, 2000). To prevent additional human exposure, EPA developed the Quality of Life Performance Standards ("QoLPS") for PCBs to ensure the protection of public health during remedial activities (EPA, 2004). In the Technical Memorandum regarding Dam Volatilization Special Study Results, Anchor QEA indicated that small quantities of PCBs were lost due to volatilization from the water column from the flow of water over the Northumberland Dam (Anchor QEA, 2011). While the quantities of PCBs observed to volatilize from the surface of the water in the study were small to minimal in terms of PCB mass, these quantities were not zero. The presence of PCBs in the air increases the risk to any population exposed to these pollutants.

In its report from February 2013, the International Agency for Research on Cancer (IARC), which is part of the World Health Organization, reassessed the carcinogenicity of PCBs in humans. IARC stated, "PCBs are persistent and bioaccumulate; they have become ubiquitous environmental pollutants" (IARC, 2013). The toxicity due to exposures of PCBs is dependent on the toxicity of individual specific congeners, the interactions between the different congeners, and interactions with other structurally related chemicals. The report also states "PCBs can induce formation of reactive oxygen species, genotoxic effects, immune suppression, an inflammatory response, and endocrine effects to various extents" (IARC, 2013). Because PCBs interact with numerous receptors sites linked to carcinogenesis, the IARC "concluded that there is sufficient evidence in humans for the carcinogenicity of PCBs" (IARC, 2013).

Thus, as long as PCBs persist in the Hudson River ecosystem, the people living in that ecosystem will continue to be exposed to PCBs through the water in the river, the fish and other

wildlife they ingest, the soil and other surfaces that they come into contact with, and the air that they breathe. Therefore, it is my opinion that any PCBs remaining in the river environment will impact all forms of life in the river ecosystem, including the inhabitants that live along the river, and those in the municipalities that rely on the Hudson River below Fort Edward as a source of water.

4.2 Mass Balance for PCBs

OPINION: While it is not possible to accurately predict precise, future concentrations of PCBs in the water of the Hudson River at any particular location or time, it is my opinion that PCBs will be present and a threat to the plaintiff municipalities that use the Hudson River as a source of water.

BASIS OF OPINION:

GE has never provided an estimate of the total amount of PCBs that entered the Hudson River to the EPA, the New York State, Department of Environmental Conservation (“NYSDEC”), or any other public agency (GE, 2012). Likewise, GE has not provided any information on the amounts of PCBs released from known point sources and non-point sources from its Hudson Falls plant and its plant at Fort Edward. In its response to the Plaintiffs’ First Request for Admissions, GE stated that the quantity of PCBs from non-point sources was unknown. GE further states that, “prior to 1975, reliable quantitative measurements of the amount of PCBs lost through point sources were not made” (GE, 2012).

There is evidence, however, that some estimates have been made. In its response to the Plaintiffs’ First Request for Admissions, GE admitted that it received over 82 million pounds of PCBs from Monsanto during the period from 1966 through September 1975 (GE, 2012). If a similar production rate was used for the period from 1951 through 1977, the total amount of PCBs handled by the GE plants would have exceeded 213 million pounds of PCBs. This is equivalent to 165,500 tons.

In 1969, J. S. Nelson prepared a report indicating 1.06 million lbs./yr (530 tons) of PCBs were disposed in water bodies including the Hudson River from the Industrial and Power Capacitor Departments at GE (Nelson, 1969). This estimate includes losses of PCBs from both the Hudson Falls plant and the Fort Edward plant. When compared with the amount of PCBs purchased from Monsanto in 1969 (GE, 2012), this yields a loss ratio of 12.7% of the PCBs

received from Monsanto. If a similar loss ratio is applied to the GE operations for the period from 1951 through 1977, the total amount of PCBs lost by the GE plants would have exceeded 27 million pounds of PCBs. This is equivalent to 13,500 tons.

In a memo to the Pyranol Task force on June 5, 1970, Dr. K.R. Murphy estimated, "About 500,000 lbs./yr of liquid PCB were discharged directly to bodies of water. The Hudson River has been the major receiving stream" (Murphy, 1970). On an annual basis, this is the equivalent of 250 tons per year. A subsequent memorandum by L.P. Hart, Jr. on June 29, 1970, revised the estimate on losses to the Hudson River, "to not be more than 50,000 pounds per year. Mr. Hart further stated, "This is substantially less than Dr. Murphy reports and by recent actions we have reduced this amount to 15,000 pounds per year" (Hart, Jr., 1970). Using these two memos and projecting the waste disposal losses for the GE operations for the period from 1951 through 1977, the estimated total amount of PCBs released by the GE plants to the Hudson River would have been in the range from 1,055,000 pounds to 13,000,000 pounds of PCBs. This is equivalent to the range of 528 tons to 13,500 tons.

It is unknown at this point as to the total mass of PCBs that have been released from the two GE facilities into the soils beneath the plants, including the fractured bedrock formations under the two plant sites, or the amount of PCBs captured with the sewer systems and released through outfalls to the Hudson River. As indicated in the Table 1, the total mass of PCBs removed from the environment by GE ranges from 630 to 814 tons, which is slightly less than 0.5% of the total mass of PCBs used by the GE facilities. Obviously, the amount of PCBs that have been removed from the environment, or have been quantified as remaining in the environment exceeds the lowest end of the range of releases suggested by the available sources. If the discharge rate indicated by Dr. Murphy is to be believed, then much more PCB mass is still unaccounted for or has yet to be identified.

Additionally from Table 1, it is clear that at a minimum, the mass of PCBs in the DNAPL and groundwater beneath the GE facilities exceeds the mass of PCBs estimated for removal from the Hudson River by a factor of 5. These DNAPL zones serve as potential, future sources of PCBs to the river, until all of the DNAPL can be removed from the fractured bedrock. Likewise, the amount of PCBs remaining in the soils and sediments at the Hudson Falls plant is as much as

4 times the mass of PCBs estimated to already be in the river by EPA. These contaminated soils and sediments will continue to recontaminate the Hudson River after dredging is completed.

Table 1 PCB Mass Recovered and Estimated Remaining in the Environment as a Result of GE Plants at Hudson Falls and Fort Edward

Location	Estimated PCB Mass	Contaminated Media	Dates
Allen Mill ^a	41 tons	Sediments	1993 - 1995
Allen Mill ^b	86 tons	DNAPL & Groundwater	1995 - 1999
Hudson Falls ^c	36 tons	DNAPL & Groundwater	1995 - 2001
Hudson Falls ^d	88 - 291 tons	Soils	2004
Fort Edward ^e	> 312 tons	DNAPL & Groundwater	2003
Hudson River ^f	75 tons	Sediments	2002

Total 630 - 814 tons

a - During its investigation and remediation of the Allen Mill, GE estimated 41 tons of PCBs were removed from September 1991 to January 1993.

b - Between April 1995 and April 1999, GE estimated oil containing 86 tons of PCBs was recovered from the bedrock wells and the Allen Mill tailrace tunnel.

c - GE estimated that over 36 tons of PCBs in oil were recovered from bedrock wells at the Hudson Falls plant between April 1995 and April 30, 2001.

d - The 2004 NYSDEC Record of Decision estimated between 176,000 to 582,000 pounds of PCBs remaining in the soils at the Hudson Falls site.

e - As part of the Remedial Design Report for OU-3 at Fort Edward, the initial volume of DNAPL was calculated at 226,855 gallons. In order for the oil phase to be a DNAPL, the PCB content must be greater than 33%. This estimate does not include the PCBs in the contaminated soils and sediments at Fort Edward.

f - The 2002 Record of Decision estimated 150,000 pounds of PCBs were contained in the sediments of the Hudson River to be removed.

The estimates of PCB mass provided in Table 1 do not account for the amount of PCBs dissolved in the water column throughout the length of the Hudson River nor do they account for the mass of PCBs that have been transported down the river into Hudson Bay below the Battery in New York City.

Further, it is unknown how much of the PCBs from the Hudson Falls facility flowed with the groundwater into the raceways of the former Allen Mill. Following the collapse of a wooden gate structure within the Allen Mill during September 1991, "PCBs in the form of DNAPL were

released into the Hudson River and continued to seep through the bedrock fractures until flow through the waterways was controlled in January 1993” (HydroQual, 1997). Although these sources have been controlled by remedial measures since 1993, PCB DNAPL from the plant site has continued to enter the river directly through fractures in the river bed. As stated by HydroQual (1997), “an active DNAPL seep was discovered within the eastern bank of the Bakers Falls plunge pool by commercial divers contracted to perform a visual inspection of the pool in September 1996” (HydroQual, 1997). These uncontrolled flows of PCB-laden DNAPL have released unknown quantities of PCBs in the Hudson River.

In the June 1997 Hudson River PCB DNAPL Transport Study, HydroQual indicated that PCB DNAPLs were found to be present within the fractured bedrock underlying the GE Hudson Falls facility. As stated by HydroQual, “This material is believed to have migrated through bedrock fractures and accumulated in waterways within the 150 year old Allen Mill” (HydroQual, 1997). From these bedrock fractures, PCBs will continue to enter the Hudson River, regardless of the groundwater control measures installed at the Allen Mill site.

GE understood and recognized that PCB DNAPL will act as a continuing source of PCB contamination to the Hudson River. In its comments on the NYSDEC Proposed Remedial Action Plan for Hudson Falls, GE stated that “The dense NAPL will act as a source of contamination to the bedrock aquifer for the foreseeable future” (NYSDEC, 2004). In its response to the Plaintiffs’ First Request for Admissions, GE admitted that “PCBs continue to be detected at low levels in the river near the Hudson Falls plant site, which indicates that low levels of PCBs are entering the river via fractured bedrock adjacent to the site” (GE, 2012). However, GE qualified this admission by stating, “since the Tunnel Drain Collection System became fully operational in June 2010, the level of PCBs entering the Hudson River appears to be declining” (GE, 2012). As such, GE has realized and admitted that DNAPL containing PCBs continue to enter the Hudson River. These continuing sources of PCBs to the Hudson River are unquantified and their impacts are as yet unknown.

Further, GE claims that these sources of PCBs appear to be declining, but they have not ceased and the mass transported to the river is not zero. For example, seepage of NAPL containing 85-86% PCBs was observed entering the raceways and tailrace tunnel from the bedrock during the Interim Remedial Measures at the Allen Mill (GE, 2012). At these

concentrations, small quantities of oil from the fractured bedrock, will transfer large masses of PCBs to the river. Furthermore, at these concentrations of PCBs in oil, droplets of oil released from the seeps will sink in the river, due to their density. At the bottom of the river, the PCB-containing oil will be transported downstream with the bed load and, more likely than not, will not be sampled by the monitoring stations as they move downriver. Alternatively, these non-aqueous phase oils may sink through the water in fractures in the bedrock of the river, where they will serve as a continuing source of contamination in the water flowing from the aquifer under the river into the Hudson River.

In addition, the removal of sediments from the Hudson River is expected to increase the exchange between surface water and the underlying bedrock aquifers. The sediments in the bottom of the river act as a semi-permeable, hydraulic barrier to the flow of water between the groundwater and the river. By removing the sediments, the hydraulic conductivity of the geologic materials overlying the aquifer will likely increase, allowing more water to flow out of the groundwater-bearing zone. With increased groundwater flow, the migration of DNAPL and dissolved-phase PCB plumes in the bedrock will be enhanced (NYSDEC, 2004).

The Feasibility Study conducted by EPA (2000) ignored DNAPLs and the dissolved PCB plume underneath Hudson River. The DNAPL source has never been addressed by GE in context with the removal of the sediment. The dredging work plan will not solve the dissolved-phase PCB contamination problem and may make it worse. In addition, the interaction of the sediments in the river with the underlying groundwater aquifers has yet to be determined. Neither EPA nor GE, has conducted any studies that would predict the impacts of sediment removal on the movement of the contaminated groundwater. Neither has GE conducted any studies on the discharge of contaminated groundwater to the river in the completed or targeted dredging areas.

To date, the amount of PCBs released by GE is unknown. The amount of PCBs in the river ecosystem and the location of where these PCBs have accumulated, have not been well characterized. Also, the amount of PCBs discharged from the river has not been quantified. We do know that 630 to 814 tons have been cleaned up or have been identified and set for removal, but we don't know how much more remains in the bedrock and sediments, or how fast these PCBs will be released to the river. We also know that dredging has resuspended and redeposited PCBs downstream, but the exact quantity and locations of these PCBs has not been identified.

While it is not possible to accurately predict precise, future concentrations of PCBs in the water of the Hudson River at any particular location or time, it is my opinion that PCBs will be present and a threat to the plaintiff municipalities that use the Hudson River as a source of water.

4.3 Dredging Failure

OPINION: It is my opinion that even with re-dredging, it is unlikely that all of the certification units in Phase 2 will meet the residual standard for closure of the certification units.

BASIS OF OPINION:

Paul Doody, a consultant to GE, has conducted an extensive review of dredging as a mechanism for remediating environmental contamination. Based on the results of dredging other contaminated sites, Mr. Doody (2001) stated, “Even with careful operations, experience has shown that sediments are unavoidably left behind after dredging. ... Because surface sediments play a central role in transferring contaminants to fish and the wider food web, any action that leaves contaminants at the biologically active sediment surface is unlikely to achieve risk-based goals requiring low part-per-million concentrations of chemicals” (Doody, 2001).

Further, Mr. Doody stated, “Dredging has not reliably and consistently removed all contaminated sediment, restored a ‘clean enough’ sediment surface, or decreased the bioavailability of contaminants. Dredging is unable to reliably and consistently achieve low residual concentrations typically sought in surface sediments even after repeated passes with the dredging equipment. The residuals left behind after dredging may be at a higher concentration and more bioavailable than before dredging, resulting in increased risk” (Doody, 2001).

The 2002 Record of Decision for the Hudson River PCBs Site selected a remedy that included the “targeted environmental dredging of approximately 2.65 million cubic yards of PCB-contaminated sediment from the Upper Hudson River”, which included an estimated 75 tons (150,000 lbs.) of PCBs (EPA, 2002). Phase 1 dredging operations, which began on May 15, 2009 was designed to remove 265,000 cy from 18 certification units. For 2011 and 2012, a design volume of 350,000 cy of sediment was targeted for removal each year (Arcadis, 2011; Arcadis, 2012). The 2013 Final Design Report specified the removal of approximately 365,000 cy of contaminated sediments with the remaining dredge areas to be completed in subsequent years (Arcadis, 2013). With the estimates for the final project coupled with the targeted volumes

for 2011-2013, it is readily apparent that GE will be required to increase its dredging efforts in order to comply with the projected completion dates.

Results from Phase 1 of the dredging project clearly showed the deficiencies of dredging as the mechanism for the removal of PCB contaminated sediments. As stated in GE's Phase 1 Evaluation Report, "Phase 1 was designed to remove 265,000 cy of sediments from 18 CUs. Phase 1 dredging removed a total of 286,000 cy. However, due to the presence of extra inventory that had not been defined by pre-design sampling and other factors, dredging was completed in only 10 of the 18 targeted CUs and did not remove the targeted inventory in the remaining CUs, even though dredging operations were extended by a month beyond the original end date" (GE, 2010). For Phase 1, an additional 21,000 cy of sediments were removed but only from 60% of the designed dredge areas, even with an additional month of operations. Obviously, GE did not have a firm understanding of the depth of contaminated sediments in the river bottom, nor did GE have a complete grasp of the extent and distribution of the contaminated sediments in the river bottom.

Further, GE failed to remove all of the targeted sediments for closure of the dredged areas in Phase 1, despite multiple re-dredging passes. As stated in GE's Phase I Evaluation Report, "Re-dredging after the first re-dredge pass was ineffective and only accounted for 7% of the PCB mass removed from the river. The first two passes in 9 of the 10 CUs together removed 90% of the PCBs in the Phase 1 areas. Re-dredging had isolated success in reducing PCB surface concentrations to below 1 mg/kg Tri+ PCB" (GE, 2010). GE further stated, "[R]epeated re-dredging passes in an attempt to meet that target were done at the sacrifice of schedule. Once dredging removed 85% of the PCB mass within a CU, attempts to remove extra inventory through re-dredging added an additional 29 days to the dredging period, but removed little additional PCB mass" (GE, 2010).

As stated in GE's Phase I Evaluation Report, "PCB concentrations tended to decrease with each pass (except for CU01). However, the Residuals Standard's goal of 1 mg/kg Tri+ PCB concentration was achieved without some capping only in CU17. All other CUs had some portion(s) of the CU that caused the CU average to be above 1 mg/kg" (GE, 2010). In its response to the Plaintiffs' First Request for Admissions, GE admitted that despite multiple

redredging attempts, the target average of ≤ 1 mg/kg Tri+ PCBs was not obtainable without some form of capping for the residual inventory in all but one area dredged in Phase 1 (GE, 2012).

Although dredging did remove PCBs from the river sediment, residual PCBs remained at concentrations above the surface concentration target in many of the dredged areas. As indicated by the Phase I results, Mr. Doody's predictions for the outcome of dredging in the Hudson River appear to have been realized. Therefore, it is my opinion that even with re-dredging, it is unlikely that all of the certification units in Phase 2 will meet the residual standard for closure of the certification units.

4.4 Erosion

OPINION: It is my opinion that capping of residual PCBs in the closed certification units is only a temporary solution to the containment of PCBs. Resuspension of the river bottom sediments is inevitable and will result in the release of PCBs into the water column and their transport downriver.

BASIS OF OPINION:

The Hudson River is a dynamic body with turbulent flow even under low flow volumes. In the main channel, water flow velocity is highly variable and subject to flow separation as the water flows through constrictions and into broader expansions of the main channel. Flow through the main channel often creates recirculation zones at the interface between regions of faster and slower moving water. These recirculation zones are observed as eddy currents in the shallower portions of the river as the faster flow of water interacts with the slower moving water adjacent to the banks. Recirculation zones increase in both size and intensity with increased discharge of water (Schmidt, 1990).

When created with sufficient energy, the recirculation zones provide the necessary force required to detach and suspend sediments from the bottom of the river in opposition to the force of gravity (Bagnold, 1966). Once lifted from the river bottom, these sediments are dispersed within the suspended zone of the water column and are transported downstream with the flowing water. At a point in the river where the water velocity decreases, the buoyant force becomes less than the force of gravity and the suspended particles are redeposited on the bottom of the river (Schmidt, 1990).

Sediment transport involves a great number of factors, not just the simplified scenario described above. Due to the complexities of the sediment transport process coupled with the variability of the river, predicting the movement of sediments within a dynamic system, such as the Hudson River, with any level of certainty is close to, if not, impossible. In certain locations, water flow velocity may be the determining factor for sediment detachment, whereas surface contour and surface roughness may be the determining factors for sediment transport. In other portions of the river channel, grain size and the cohesiveness of the sediments may play a key role in the availability of sediments to be suspended.

Further, during high energy flow events, sediments at a particular location can effectively be removed by sediment transport in a process called scouring. Scouring of the river bed has been observed to occur during peak flow events, especially during rising flood stages. Once removed, the sediments are replaced with new deposits upon the return of the river flow to normal stages (Gomez, 1991).

As a general trend, sediment transport occurs during high flow events. For the Hudson River, these high flow events occur as seasonal, annual events. As indicated in his June 2012 deposition, John Connolly stated, "There are general flow patterns which say that high flows occur in most rivers in the northeast, including the Hudson River, in the springtime, associated with snow melt. So if the degree of scientific certainty you need is to predict whether or not you are likely to have a high flow event in the spring, you can be fairly accurate almost every year. There is a high flow in the spring" (Connolly, 2012).

High flow events in March and October 2010 illustrated the resuspension and downstream transport of PCBs in the Hudson River. These two events have demonstrated that high flow in the river increased the PCB concentrations in the water as much, if not more than, the actual dredging activities. Samples collected from the water column during the March 2010 high flow event contained PCB concentrations in excess of the 500 ng/L Total PCB standard set by EPA. As an example, the composite samples collected on March 25, 2010 at Lock 5 and the Waterford monitoring station were found to contain 560 ng/L and 1890 ng/L PCBs, respectively (EPA, 2013). Based on a review of the sampling results from 2009 through 2012, elevated concentrations of PCBs in the river associated with high flow events occur as frequent, seasonal events. With the trend in sampling results from 2009 through 2012, it is therefore, logical to

expect high flow events with elevated water concentrations of PCBs to occur with a recurring frequency (EPA, 2013). Therefore, it is my opinion that capping of residual PCBs in the closed certification units is only a temporary solution to the containment of PCBs, and resuspension of the river bottom sediments is inevitable and will result in the release of PCBs into the water column and their transport downriver.

4.5 Resuspension

OPINION: It is my opinion that alternative water supplies were required for the communities during dredging and will be required long after dredging is completed to minimize further exposure to PCBs.

BASIS OF OPINION:

In “An Evaluation of Environmental Dredging For Remediation of Contaminated Sediments, Paul Doody stated, “The physical mixing action of the dredge inevitably stirs up sediments, releasing both suspended and dissolved contaminants to the water column. Although there are devices to reduce resuspension and the dredge operator can modify certain operating parameters such as production rate, no dredging method has totally eliminated local sediment resuspension. Sediments resuspended during dredging will eventually settle on the surficial layer of the area dredged or be transported and redeposited outside or downstream of the removal area. Thus, for contaminants with an affinity for binding to sediments, surface sediments both within and outside the removal area may become more contaminated than before dredging” (Doody, 2001).

EPA admitted that the dredging of the Upper Hudson River will release PCBs into the water column of the river. In order to address this release of contaminants to the river, EPA developed a set of Engineering Performance Standards to “reduce PCB concentrations in river (surface) water that are above applicable or relevant and appropriate requirements for surface water” and “[M]inimize the long-term downstream transport of PCBs in the river” (Malcolm Pirnie, 2003).

Based on the analyses performed to develop the Engineering Performance Standards, EPA determined that compliance with the standards will “limit the concentration of total PCBs in the river water within one mile or more downstream of the dredging area to levels that are acceptable for potable water under the requirements of the Safe Drinking Water Act” (Malcolm

Pirnie, 2003). According to the Engineering Performance Standards, one of the EPA's primary objectives was, "the residuals criterion identified in the ROD (approximately 1 mg/kg Tri+ PCBs remaining in dredged areas, prior to backfilling) is achievable based on case studies of other environmental dredging project and can be applied in the Upper Hudson on an area-wide average basis" (Malcolm Pirnie, 2004).

Both GE and EPA developed numerical models that describe PCB transport in the Upper Hudson River (Connolly, et al., 2009; EPA, 2000). The results of the models are driven by the underlying assumption that the sediments are the major source of PCBs in the water in the Hudson River. While similar, the GE model and EPA model have some key differences related to the extent of PCB release from the sediments and neither of the models accounted for other PCB sources which can release PCBs including DNAPLs and contaminated groundwater plumes, which have the potential to transfer large masses of PCBs to the river. As indicated in a white paper prepared for the Hudson River Foundation, "the lack of fine-scale spatial resolution in the sediment transport model and the use of an overly simplistic PCB distribution and bioaccumulation models limit the ability of either model to accurately project future PCB levels in the Upper Hudson River, with or without active remediation" (Hudson River Foundation, 2001).

The release rate of PCBs due to dredging is highly variable and dependent on multiple factors. As seen from the results of Phase 1, EPA's model grossly under-predicted the actual release of PCBs due to dredging. In GE's Phase I Evaluation Report, GE stated, "Dredging activities caused previously buried PCB-containing sediments to migrate downstream and settle on the surface of the river bottom, where they became bioavailable. PCB concentrations in downstream sediments traps ranged from approximately 24 to 126 mg/kg Total PCBs, with an average of 61 mg/kg, and downstream sediment cores of previously sampled areas showed an average increase of three times pre-dredging concentrations" (GE, 2010). GE further stated, "These re-deposited sediments continued to release PCBs to the river well after the completion of dredging activities" (GE, 2010). Additionally, installation of sheet piling and other controls, such as flow-related restrictions, restricted equipment operations, and alternating dredge areas, did not substantially reduce resuspension (GE, 2010).

According to EPA, resuspension of sediments containing PCBs due to dredging would have a negligible effect on the river. In its Responsiveness Summary to the Hudson River PCBs Site Record of Decision, EPA and the US Army Corps of Engineers stated that the predicted loss rate of sediment containing PCBs would range from 0.3 to 0.35% by mass (TAMS Consultants, 2002). However, as stated in GE's Phase I Evaluation Report, "During Phase 1, the overall rate of resuspension was 3% of the mass of PCBs dredged, and was 4% outside the areas with resuspension controls" (GE, 2010).

Likewise, in the Resuspension Standard, EPA set an action level of 500 ppt of total PCBs in the water column as the standard for ceasing dredging operations and implementing contingencies (Malcolm Pirnie, 2004). During Phase 1, the Resuspension Standard threshold level of 500 ppt was exceeded in 10 samples at the Thompson Island station including 4 samples where GE used an updated correction factor (GE, 2012). Additionally, 15 off-season samples, collected from far-field monitoring stations after the completion of Phase 1 dredging, had concentrations exceeding the 500 ppt resuspension standard during the March 2010 high flow event.

In its response to the Plaintiffs' First Request for Admissions, GE admitted that the 7-day running average of 1080 g/day of Total PCBs and 361 g/day of Tri+ PCBs, established as the Control Level criteria for net load of PCBs during Phase 1, was exceeded for 152 of the 166 days (92%) at one or more of the far-field stations during Phase 1 (GE, 2012). In the Phase I Evaluation Report, GE stated that Phase 1 dredging released approximately 500 kg of Total PCBs past Thompson Island and about 200 kg of PCBs past Waterford into the lower Hudson River. The mass of resuspended PCBs greatly exceeded the net load standard of 117 kg (GE, 2010). As GE concluded, "These and other lines of evidence show that dredging caused widespread redistribution of PCB-containing sediments on the surface of the river bottom" (GE, 2010).

Clearly, PCBs have been and continue to be resuspended by dredging and transported downstream. Because of the variability in the flow of the river, some of the resuspended PCBs remain suspended in the water column, potentially impacting the municipal water supplies. Other portions of the resuspended PCBs are redeposited in random locations by the irregular flow of the river, where they are subject to further erosion and transport. The quantity and concentration

of the resuspended PCBs is uncertain, but has been shown to occur through increased PCB concentrations in water column samples during dredging and during the dredging offseason. These elevated PCB concentrations are likely to continue through the end of dredging and after dredging is completed. Therefore it is my opinion that alternative water supplies were required for the communities during dredging and will be required long after dredging is completed to minimize further exposure to PCBs.

4.6 Uncertainty

OPINION: It is my opinion that since the mass of PCBs transported in surface sheens and the bed load has not been quantified and the placement of redeposited PCBs has not been identified, future impacts due to these PCBs or the timing of the impacts from these PCBs, cannot be predicted with any level of certainty to permit the plaintiff municipalities to utilize the Hudson River as a safe source of drinking water supply not threatened by PCBs.

BASIS OF OPINION:

The ongoing transport of PCBs in the form of resuspended sediments, dissolution in the water column, and surface transport as oil sheens, or as transport with the bed load of sediment in the river bottom, has exceeded the dredging project's engineering performance standards in both Phase 1 and Phase 2. In the 2013 Phase 2 Final Design Report, GE stated, "it is difficult to quantitatively predict PCB net loads and in-river PCB concentrations for future dredging because planned dredging sequence/production rates are subject to change, river flows are not known, and residual PCB concentrations after design cut dredging are uncertain" (Arcadis, 2013). This variability leads to a large uncertainty as to the mass of PCBs released to the water column by dredging, as well as, the mass of PCB contaminated sediments left after dredging and the rate at which they will become resuspended and transported downstream.

Further, the release rate of PCBs due to dredging is highly variable and dependent on multiple factors. Paul Doody, one of GE's consultants, stated, "issues regarding resuspension include the fact that: 1) a portion of the resuspended contaminants fall back onto the dredged surface, making attainment of a low cleanup level extremely difficult, particularly if deep sediments containing higher levels of contaminants are resuspended and redeposited on the surface, and 2) 'resuspension plumes' tend to stay close to the bottom as they move away from

the dredge, in which case, downstream surface water samples may not detect the bulk of resuspended material” (Doody, 2001).

As seen from the results of Phase 1, EPA’s model grossly under-predicted the actual release of PCBs due to dredging. EPA predicted that the loss rate of sediment containing PCBs would range from 0.3 to 0.35% by mass (TAMS Consultants, 2002). However, the actual amount of PCBs lost through resuspension was tenfold greater than predicted by EPA. As stated in GE’s Phase I Evaluation Report, “During Phase 1, the overall rate of resuspension was 3% of the mass of PCBs dredged, and was 4% outside the areas with resuspension controls” (GE, 2010).

In GE’s Phase I Evaluation Report, GE stated, “Dredging activities caused previously buried PCB-containing sediments to migrate downstream and settle on the surface of the river bottom, where they became bioavailable. PCB concentrations in downstream sediments traps ranged from approximately 24 to 126 mg/kg Total PCBs, with an average of 61 mg/kg, and downstream sediment cores of previously sampled areas showed an average increase of three times pre-dredging concentrations” (GE, 2010). GE further stated, “These re-deposited sediments continued to release PCBs to the river well after the completion of dredging activities” (GE, 2010). At any time, the water in the river is subject to a spike in PCB concentrations causing the water to be unfit for human consumption. Not a question of if, but when.

When contacted with the flowing water, a portion of the PCBs adsorbed to the sediments will partition from the solid phase into the water, depending on the flow rate and the composition of the sediments. The dissolution of PCBs in the water column increases the concentration of PCBs in the water as demonstrated by sample results for Thompson Island during the 2011 dredging season (EPA, 2013). These dissolved PCBs are transported downstream, where they can enter the intake to the public water supplies or infiltrate the Stillwater well field.

While high concentrations of PCBs were detected in the sheens during dredging, their presence alone is not indicative of the movement of free phase PCBs in the river. The Hudson River has been contaminated with petroleum oils from a variety of sources for over a century. These include losses of oil from vessels on the river, which used oil for fuel and lubrication. Additionally, oil has historically been transported up the river to various locations. Oil has also been discharged by various industries as part of their waste into the river. While these sources

have diminished in the recent past, there are on-going sources of oil including runoff from streets and roadways which discharge into the river.

Portions of these oils are attached to the sediments in the river. PCBs, which were discharged to the river by GE, strongly partitioned from the water into oils. The typical density of petroleum oils is about 0.8 g/cm^3 , while PCBs have a density that ranges from 1.38 g/cm^3 for Arochlor 1242 to 1.55 g/cm^3 for Arochlor 1260 (Monsanto, 1995). The concentration of PCBs in the petroleum oils will determine if droplets of oil, released from the sediment during coring, sheet piling, inventory dredging, or scouring by water flowing in the river, will float or sink. When the concentrations of PCBs in the oil are less than about 33%, the droplets of oil will float and be part of a sheen. When the concentrations are great enough to cause the oil droplet to have a density greater than 1.0 g/cm^3 , the droplets of NAPL will sink where they will flow with the bed load, be entrained with the sediment at the bottom of the river, or will sink into the cracks of the bedrock where it is exposed in the bottom of the river.

Thus, the appearance of sheens is only an indication of part of the NAPL transport system in the river. While it is not possible to quantify PCBs transported in sheens, at least they can be seen. PCBs dissolved in oil and transported in the bed load cannot be seen, but likely constitute a significant transport mechanism which cannot be quantified by measuring PCBs in the water column of the river.

EPA uses one percent of the effective solubility of a constituent in a mixture to indicate the presence of a DNAPL in contact with groundwater (EPA, 1992). The likelihood that a groundwater sample is being impacted by DNAPL, is indicated when the aqueous concentration of the constituent exceeds one percent of the effective solubility of that constituent in the mixture. Applying the same standard to water in the Hudson River, samples containing Arochlor 1254 concentrations greater than 225 ppt. suggest that the water is in contact with a NAPL containing Arochlor 1254. For samples containing Arochlor 1248 concentrations in excess of 1024 ppt indicate that the water is in contact with a NAPL containing Arochlor 1248. For the Waterford monitoring station, 7 samples have been reported during 2010 and 2011 to contain over 225 ppt total PCBs. Additionally, 2 samples collected during the high flow events in March 2010 and May 2011, contained over 1600 ppt total PCBs indicating the possible presence of NAPLs containing PCBs in the river.

Further, bed load transport of PCBs has not been quantified. As indicated in his 2012 deposition, John Connolly agreed that PCBs transported with the bed load of sediments can bypass the sampling devices and not be quantified with the collected sample (Connolly, 2012). Since the mass of sediments and PCBs transported with the bed load increases with increasing flow rates and velocity in the river, the fluctuations in flow of the river create even further uncertainty in the quantity and location of the redeposited PCBs.

Therefore, the ongoing transport of PCBs creates concentrations of PCBs in the water that are unsuitable for human consumption or intake to public water supplies. Thus, it is my opinion that since the mass of PCBs transported in surface sheens and the bed load has not been quantified and the placement of redeposited PCBs has not been identified, future impacts due to these PCBs or the timing of the impacts from these PCBs, cannot be predicted with any level of certainty to permit the plaintiff municipalities to utilize the Hudson River as a safe source of drinking water supply not threatened by PCBs.

4.7 Sampling and Monitoring

OPINION: In my opinion, a stationary monitoring location collecting a time-weighted average sample will not capture the maximum concentrations of resuspended PCBs in the water column. Therefore, stationary monitoring will not be adequate for predicting the concentrations of PCBs in the water at the intake to a public water supply with any level of surety.

BASIS OF OPINION:

As indicated in the Engineering Performance Standards, near-field monitoring stations are located within 300 meters of the active dredging operations. Samples are collected from mid-water column depths by the stationary monitoring locations within the river channel. However, due to fluctuations in the flow of the river and the presence of variable currents within the river, it is not likely that any resuspended sediment will be evenly distributed across the monitored section of the river. In the absence of complete mixing, portions of the river, both laterally and vertically, will contain elevated concentrations of sediments and PCBs, while others will have substantially less.

Concentrations in the river have been and continue to be highly variable. As an example, grab samples collected concurrently with the composite samples showed concentrations of PCBs up to three times greater than the result of the composite samples. As indicated in the NYSDEC

Phase 1 Oversight Report, “data generated during sampling events where samples from the automated station were analyzed and compared to manually collected transect samples from the river water column at the automated sampler location. In these paired data, it appears that there may be a difference in the results such that a daytime manual sample is typically ~50% higher than the automated sample” (NYSDEC, 2010).

Further, dredging is an active operation. The active working face of sediment removal changes during the daily operation. As the dredge moves, so does the point of release of the resuspended sediments. Therefore, the placement of the monitoring station is critical to capturing the portion of the river impacted with resuspended sediments from dredging. The likelihood that the positioned monitoring stations will capture the maximum concentration of resuspended sediments is not probable and an uncertainty due to placement of the monitoring stations will be associated with the measurement of PCB concentration in these samples. Due to the uncertainty associated with the measurement of PCB concentration, the accuracy of the sample concentrations in relation to the actual concentration of PCBs released by the dredge is unknown.

As specified in the Community Health and Safety Plan, composite samples are to be taken over a 12-hour period at the Thompson Island pool (EPA, 2006, Consent Decree Modification No.1). Since a composite sample is essentially a time-weighted sample, composite sampling will not provide information on temporal conditions or short-term spikes in concentration of the water column. Composite samples will not guarantee that representative concentrations of PCBs in the water are measured.

In addition, Arochlors are mixtures of different congeners. Lighter fractions with lower degrees of chlorination are more readily partitioned from the sediment or oil to the dissolved phase. Heavier congeners with higher degrees of chlorination tend to remain bound in solid forms (EPA, 1995). Stationary monitoring locations will not capture sheens containing PCBs at the surface of the water or PCBs adsorbed to sediments moving downriver with the bed load.

Without a doubt, the use on stationary monitoring locations introduces multiple points of uncertainty as to the actual concentrations of PCBs released from the dredged sediments. Further, the uncertainty associated with the sample collections, severely limits GE’s ability to monitor and predict the impacts caused by these PCBs to the Hudson River. In my opinion, a

stationary monitoring location collecting a time-weighted average sample will not capture the maximum concentrations of resuspended PCBs in the water column. Therefore, it is my opinion that stationary monitoring will not be adequate for predicting the concentrations of PCBs in the water at the intake to a public water supply with any level of surety.

4.8 Standards

OPINION: It is my opinion that the higher mass loading and increased concentrations allowed under the Engineering Performance Standards in Phase 2, pose an additional risk to the water supplies of the plaintiff municipalities.

BASIS OF OPINION:

In April 2004, EPA issued peer-reviewed Engineering Performance Standards (“EPS”), which included a Resuspension Standard, a Residuals Standard, and a Productivity Standard. The objectives of the EPS were to 1) maintain PCB concentrations in the water column at or below the federal MCL of 500 ng/L to protect downstream municipal intakes; 2) minimize the release of PCBs from sediment during remedial dredging; and 3) minimize the transport of PCBs to downstream areas, including the Lower Hudson River (Malcolm Pirnie, 2004). These performance standards were designed to promote accountability on the part of GE and its contractors and to ensure that the cleanup meets the human health and environmental protection objectives set forth in the 2002 ROD. As stated in the 2009 Community Health and Safety Program, “The performance standard, established action levels and required response actions, which are based on the federal drinking water standard, are designed to protect downstream public water supplies” (Parsons, 2009).

In the 2004 Engineering Performance Standards, EPA specified the following standards:

1. The *Performance Standard for Dredging Resuspension* established that remedial activities during dredging may only proceed when the ambient Total PCB concentration in the water of the river is 500 ng/L or less. A Control Level of 350 ng/L of Total PCB concentration maintained as a 7-day running average concentration was set as the control to limit resuspension with a net load standard of 600 g/day.

2. The *Performance Standard for Dredging Residuals*, designed to detect and manage contaminated sediments that may remain after initial dredging was set as an arithmetic average Tri+ PCBs concentration in the residual sediments of < 1 mg/kg.
3. The *Performance Standard for Dredging Productivity* was designed to monitor and maintain the progress of the dredging project to meet the schedule stated in the ROD. The target production volume for Phase 1 of the project was established to remove 265,000 cy of contaminated sediments. The target production volume for Phase 2 was set for an annual removal of 530,000 cy of contaminated sediments.

In its response to the Plaintiffs' First Request for Admissions, GE admitted that resuspension had an impact during Phase 1 that was not anticipated in the EPA's Engineering Performance Standards. GE also admitted that Phase 1 dredging caused some PCBs to be resuspended and redeposited on the river bottom outside the areas that were dredged, creating a bioavailable layer of sediment that contributes (to some unknown extent) to PCB flux to the river (GE, 2012). GE further indicated that dredging associated with Phase 1, released approximately 500 Kg of Total PCBs at the Thompson Island station with approximately 200 Kg of PCBs transported past the Waterford Station to the Lower Hudson River (GE, 2010).

In their Phase 1 Evaluation Report, GE stated that the Control Level criteria for net load of PCBs during Phase 1, was exceeded for 152 of the 166 days (92%) at one or more of the far-field stations during Phase 1 (GE, 2010). Additionally, the release of the estimated 200 Kg of PCBs to the Lower Hudson River exceeds the net load standard set by EPA for the Phase 1 dredging. At the estimated rate loss, the net load resuspended and released to the river exceeded EPA's stand by almost 7 times at the Thompson Island station and nearly a two and one half fold excess at the Waterford station (GE, 2010). Further, GE stated that, unless the Engineering Performance Standards were modified, "Phase 2 would mobilize a significant mass of PCBs - some 5,200 kg would be released to the first far-field station. This exceeds the total allowable mass for the project by many-fold, effectively erasing the potential benefits of dredging" (GE, 2012).

During Phase 1 of the dredging project, concentrations of PCBs resuspended in the water column as a result of dredging exceeded the acceptable concentration standards set by EPA. As evidenced by the monitoring data from the Thompson Island monitoring station during Phase 1,

five composite samples collected during the period from August through October 2009 exceeded the EPS Resuspension Standard and another 19 composite samples exceeded the EPS Control Limit (EPA, 2013). In their Phase I Evaluation Report, GE indicated that dredging activities caused PCB contaminated sediments to become resuspended and transported downstream where these sediments settled on the bottom of the river bed. Sampling of sediment cores following Phase 1, showed an average increase of three times the concentration of PCBs in the pre-dredging samples (GE, 2010).

Dredging conducted during Phase 1 of the project failed to remove all of the targeted mass of PCBs from the river for the dredged areas. With regard to the EPS Residual and Productivity Standards, GE stated, “Phase 1 was designed to remove 265,000 cy of sediments from 18 CUs. Phase 1 dredging removed a total of 286,000 cy. However, due to the presence of extra inventory that had not been defined by pre-design sampling and other factors, dredging was completed in only 10 of the 18 targeted CUs and did not remove the targeted inventory in the remaining CUs, even though dredging operations were extended by a month beyond the original end date” (GE, 2010). During Phase 1, only one of certification units has successfully achieved the residual standard of 1 mg/kg TRI+ PCBs prior to closure.

Despite the failure to comply with the Engineering Performance Standards, EPA decided to revise the Engineering Performance Standards for Phase 2 of the dredging project. As stated in the Revised Engineering Performance Standards For Phase 2 “[T]he standards have been modified based on the findings of EPA and GE as reported in their respective Phase 1 evaluation reports, the recommendations and observations of the Peer Review Panel, and additional analyses by EPA. Further, the standards have been simplified and streamlined to more directly reflect the conditions that were observed during the day-to-day operations of the dredging project” (Louis Berger, 2010). For the revised standards, an adaptive management approach was implemented to assure that the EPS conform to the observed conditions in the river as the project progresses.

In the 2010 Revised Engineering Performance Standards for Phase 2, EPA specified the following standards:

1. The Performance Standard for Dredging Resuspension in Phase 2 established that remedial activities during dredging proceed when the ambient Total PCB

concentration in the water of the river is less than the Control Level of 500 ng/L. The acceptable net load was increased to 2-3% of the PCB mass removed by dredging with the loss rate dependent on the volumetric flow of the river.

2. The Performance Standard for Dredging Residuals in Phase 2, remained as the arithmetic average Tri+ PCBs concentration in the residual sediments of < 1 mg/kg. However, certification units and subunits require additional verification of design dredge elevations subsequent to dredging.
3. The Performance Standard for Dredging Productivity was designed to monitor and maintain the progress of the dredging project to meet the schedule stated in the ROD. The target production volume for Phase 2 was set for an annual removal of 350,000 cy of contaminated sediments.

The Engineering Performance Standards were designed to protect downstream public water supplies. By complying with the Engineering Performance Standards in Phase 1, EPA determined that the water from the Hudson River could be safely used as a source of water for the municipal water supplies. GE, however, was unable to consistently meet the Engineering Performance Standards during Phase 1. The revised Engineering Performance Standards developed for Phase 2 of the project have increased the allowable quantity of PCBs that can be released to the water column as a result of dredging. The increased water column loading of PCBs poses an additional risk with greater uncertainty, to the water supplies drawing water from the Hudson River. Therefore, it is my opinion that the higher mass loading and increased concentrations allowed under the Engineering Performance Standards in Phase 2, pose an additional risk to the water supplies of the plaintiff municipalities.

4.9 Fingerprint

OPINION: In order to restore the well field for future use, it is my opinion that the PCBs in the aquifer materials of the Stillwater aquifer must be removed and the aquifer must be isolated from the river so that infiltration from the river cannot recontaminate the aquifer.

BASIS OF OPINION:

The Village of Stillwater has historically utilized groundwater from a well field adjacent to the Hudson River for its municipal water supply. The Village of Stillwater well field was constructed on a point bar of the Hudson River within approximately 120 feet of the river, into a

water-bearing sand and gravel zone. The water bearing zone is overlain by fine-grained, flood plain sediment. The aquifer from which the supply wells draw water has been classified by the New York State Department of Health (NYSDOH) as Groundwater Under the Direct Influence (GWUDI) of Surface Water.

The Village of Stillwater Well Field Investigation Report (Malcolm Pirnie, Inc. 2009) confirmed that the Stillwater aquifer is hydraulically connected to and under the direct influence of the Hudson River. Recharge from the Hudson River to the well field has led to the infiltration and transport of PCBs into the well field and contamination of the aquifer soils. The PCBs within the aquifer soils have similar chemical fingerprints as the PCBs released from the GE plants, based on the congener analysis and homologue patterns of the aquifer soils and groundwater samples (Malcolm Pirnie, 2009). Based on the 2009 evaluation of the geology and hydrogeology of the Stillwater well field, the Village of Stillwater wells draw a majority of its total water volume from the Hudson River with only a small portion from regional groundwater sources. Any future pumping of this well field will introduce more PCBs from the river into the aquifer (Malcolm Pirnie, 2009).

Water quality sampling conducted by the New York State Department of Health (“NYSDOH”) in 2008, indicated PCB concentrations ranging from 42.3 to 200.9 ng/l in the groundwater samples from the Village of Stillwater water supply wells (Malcolm Pirnie, 2009). From their field investigation activities, Malcolm Pirnie estimated the mass ratio of PCBs in the soils of the aquifer to PCBs in the groundwater to be 1500 to 1. From the analysis of the aquifer soil samples, Malcolm Pirnie concluded, “PCB concentrations and homologue patterns in subsurface, aquifer soils indicate that the current, primary source of dissolved-phase PCBs in the groundwater is the saturated soil in the aquifer matrix” (Malcolm Pirnie, 2009). Further, Malcolm Pirnie stated, “[T]he primary contaminant transport mechanism is PCB partitioning from the soil to the groundwater, which indicates a long-term, persistent source of dissolved-phase PCBs in the well field” (Malcolm Pirnie, 2009). Clearly, from the mass ratio and the transport mechanism for groundwater contamination, the contaminated soils in the aquifer will continue to release PCBs into the groundwater for the foreseeable future and thus, the well field cannot be used as a source of drinking water.

If the aquifer is to be used again for a source of potable water, PCBs entering the aquifer from the river must stop and the PCB mass contained in the aquifer matrix must be removed. From a practical perspective, the installation of a non-permeable barrier can segregate the aquifer from the river to prevent the infiltration of water and PCBs from the river. However, the isolation of the aquifer must precede any remedial action to remove the residual PCBs in the aquifer.

The residual PCBs in the aquifer soils cannot be chemically treated due to the relative lack of reactivity and high stability of PCBs in the aquifer. Likewise, the residual PCBs in the aquifer soils cannot be effectively removed by flushing or purging of the aquifer due to the proclivity of PCBs to remain adsorbed to the aquifer soils. Also, natural attenuation of the aquifer is not a viable option because of the longevity of PCBs in the environment. By process of elimination, excavation and backfill of the aquifer materials presents the only viable option for the permanent removal of the residual PCBs. Therefore, in order to restore the well field for future use, it is my opinion that the PCBs in the aquifer materials of the Stillwater aquifer must be removed and the aquifer must be isolated from the river so that infiltration from the river cannot recontaminate the aquifer.

4.10 Long Term

OPINION: It is my opinion that even with the ongoing remediation, the time required to return the PCB concentrations in the river to levels before the start of dredging could take decades if not longer.

BASIS OF OPINION:

With all of the uncertainty associated with ongoing sources of PCBs entering the river, the variability of PCB concentrations dissolved in the water column, and the undetermined amount of residual PCBs left in the sediments after dredging as well as the fate and transport of PCBs resuspended in the river, it is impossible to predict the long term consequences of PCBs on the residents of the communities along the Hudson River. Further, it is unrealistic to project the future concentrations of PCBs in the water column of the river or the future concentrations of PCBs in the water supply sources connected to the river with any certainty.

In GE's Phase 1 Presentation (June 2010), John Connolly projected the cumulative load of PCBs to the river, assuming no redeposition of PCBs from dredging operations. When compared with the natural attenuation processes in the river, Dr. Connolly concluded that there

will be no net benefit to the river due to dredging until 2036 (Haggard and Connolly, 2010). Based on this prediction, a positive, net benefit is not likely to occur in less than 30 more years.

However, Dr. Connolly's model does not take into account the redeposition of suspended sediments caused by dredging. Additionally, Dr. Connolly did not provide any information on potential increases or decreases in PCB water concentrations following dredging. Since redeposition of sediments has been observed in both Phase 1 and Phase 2, the accuracy of Dr. Connolly's model prediction is questionable. Further, as indicated in the GE's response to the Plaintiffs' First Request for Admissions, GE admitted that Phase 1 dredging caused some PCBs to be resuspended and redeposited on the river bottom outside the areas that were dredged. These redeposited sediments contribute, to some unknown extent, to the PCB flux in the river (GE, 2012). When redeposition of PCBs is considered, the projected date for net benefit will likely be even later than predicted by John Connolly.

Due to the unknowns associated with ongoing sources of PCBs entering the river as well as the fate and transport of PCBs currently in the river, it is unrealistic to project the future concentrations of PCBs in the water column of the river with any certainty. Further, it is not possible to accurately predict the precise, future concentrations of PCBs in the water supply sources connected to the river, with any level of confidence. Therefore, it is my opinion that even with the ongoing remediation, the time required to return the PCB concentrations in the river to levels before the start of dredging could take decades if not longer.

4.11 Alternative Water

OPINION: It is my opinion that until all of the PCBs already in the river and the sources of PCBs still entering the river have been identified and removed, including those in the well field at Stillwater, an alternative water source that is proven and reliable, must be available to the Village of Stillwater and the Towns of Waterford and Halfmoon to protect against the risk of unacceptable amounts of PCBs threatening the water supplies.

BASIS OF OPINION:

Residents of the communities along the Hudson River have been exposed to elevated concentrations of PCBs since the mid-1940s. These exposures have come through the water that they drink, the air that they breathe, the fish from the river that they ingest, and the contact they have with contaminated soils and river sediments. Because PCBs bioaccumulate in the lipids and

fatty tissues in humans, the small amounts taken up daily by these exposed individuals are retained for the lifetime of the individual. Children in development stages are one of the most susceptible groups to PCB exposure (Carpenter, 2009). Further, “there are no known treatment methods for reducing body burden of PCBs” (ATSDR, 2000).

As indicated in 2009 Water Column Monitoring Data for Far-Field Stations, there were 49 out of 183 water samples collected from May 13, 2009 through November 15, 2009 at the Waterford monitoring location that exceeded the NYS standard of 90 ppt (EPA, 2013). Following the dredging season, there were 6 samples taken at the Waterford monitoring location during a high flow event from March 23, 2010 through March 25, 2010, that exceeded the NYS standard of 90 ppt, including one sample at a concentration of 1890 ppt (EPA, 2013). A similar trend was observed in 2011 during the high flow event of April 29, 2011 through May 16, 2011. During the 2011 high flow event, 7 samples exceeded the NYS standard of 90 ppt, including one sample with a concentration of 1640 ppt (EPA, 2013). Based on recent trends and the expected occurrence of a high flow event each year, the concentrations of PCBs in the water of the river will be expected to exceed the NYS standard.

With the uncertainties associated with the concentrations of PCBs in the water from the river supplied to the residents in these communities, people may be exposed to additional concentrations of PCBs without ever knowing of the exposure. Additionally, it is unacceptable for the residents in these communities to be further exposed to PCBs as a result of contaminated or unreliable water supplies.

GE has acknowledged the potential for health concerns due to additional exposures to PCBs and the need for a safe, reliable water supply. In the 2012 Community Health and Safety Plan, GE indicated that EPA, with contributions from GE, will pay for water costs for the Town of Waterford and the Town of Halfmoon during the 2012 dredging season. GE also stated, “The Towns obtained their water from the City of Troy water supply throughout the 2011 dredging season, and it is expected that they will continue to receive water from Troy throughout the 2012 dredging season” (Parsons, 2012).

Since there are fluctuations in the flow of the river and widely variable PCB concentrations within the channel of the river, the concentrations reported for the Waterford monitoring station will not be representative of the water drawn from the river by the public

water systems. Until there are no longer any releases or threatened releases of PCBs to the river and all of the PCBs already in the river have been sequestered or removed, including those in the well field at Stillwater, the water drawn from the Hudson River is not suitable as a drinking water source. Therefore, it is my opinion an alternative water source that is proven and reliable, must be available to the Village of Stillwater and the Towns of Waterford and Halfmoon to protect against the risk of unacceptable amounts of PCBs threatening the water supplies.

4.12 Permanent Water Supply

OPINION: In my professional opinion, the only viable way to ensure safe drinking water for the residents of Stillwater, Halfmoon, Waterford, and Saratoga County, is to provide a permanent, alternate water supply.

BASIS OF OPINION:

Removal of the contaminated sediments from the Hudson River will not remove all of the PCBs from the water column. Elevated concentrations of PCBs will remain in the water of the river even if dredging operations proceed with zero losses of PCBs. As indicated by John Connolly, “Both the NCP and CERCLA require that remedial response actions comply with all applicable Federal standards; any State standards that may be more stringent than the Federal Standards; and the Maximum Containment Level Goals (“MCLG”) for all contaminants of concern” (Connolly, 2012).

In the development of its Risk-Based Concentrations (RBCs), EPA Region III has developed a set of equations to calculate the risk-based concentration for PCBs via water ingestion. The risk-based concentration for PCBs in tap water is 33 ppt at a cancer risk level of one in a million (EPA, 2008). Any additional exposure to PCBs increases the risk of the exposed population to cancer and other health effects. It is unthinkable to assume that during dredging and even after dredging, additional PCB exposure will not occur until the levels of PCBs in the river increase above 500 ppt.

Further, it is well known that dredging, will resuspend PCB containing sediments into the water column, where they are transported and redeposited at some point further downstream. The freshly deposited sediments are readily available for uptake by fish, partitioning into the aqueous phase, or further transport with the bed load.

Since dredging or any other remedial action will not reduce the concentration of PCBs in the water column to zero, the only guaranteed way to eliminate additional exposure to the people in Stillwater, Halfmoon, Waterford, and Saratoga County is to eliminate the Hudson River as the source of drinking water for these individuals. Therefore, it is my opinion that the only viable way to ensure safe drinking water for the residents of Stillwater, Halfmoon, Waterford, and Saratoga County is to provide a permanent, alternative drinking water source.

5.0 SUMMARY

Currently, it is unknown how much PCB mass was released to the environment by GE at the Hudson Falls and Fort Edward plants. Of this mass, it is unknown how much of these PCBs entered the Hudson River, and how much remains in the soil and groundwater at the plant sites. It is known, however, that PCBs continue to enter the river at the plant sites, although, the quantity and timeframe for release to the river cannot be predicted with any certainty.

In the river, dredging has and will remove PCBs from the river sediments. However, it is unknown what total mass of PCBs will remain and where these PCBs will be located after dredging. Then again, dredging causes the release of PCBs from the dredged sediments into the water in the river, as shown by the concentrations of PCBs in the sheens and in the water column samples. Also, during dredging, the released PCBs are redistributed and redeposited on the surface of the bottom of the river. In these locations, the freshly deposited PCBs are more bioavailable, and are more subject to transport downstream, than inventory PCBs buried in deeper layers of the sediments. It is undetermined how much of the freshly deposited PCBs contribute to the bed load for downstream transport. However, the concentrations of PCBs in the river increased during high flow events in the river, often to concentrations greater than both the New York state and Federal drinking water standards (EPA, 2013).

Despite GE's efforts to sample PCBs in the Hudson River, the results of these analyses are highly variable, due to the heterogeneous nature of the river. Despite the efforts made, the results from a single sample location do not adequately represent the concentrations of PCBs across the entire span of the river. With these deficiencies, the sampling efforts do not allow adequate warning for the communities to rely on water from the river as a source of drinking water. Further, the aquifer at Stillwater is contaminated and will need to be cleaned and isolated from the river before it can be used as a source of drinking water (Malcolm Pirnie, 2009).

Neither EPA nor GE has put forward a long-term plan to monitor water in the river following the completion of dredging. Even if there were such a plan, such monitoring, with the present technology, will likely not provide representative concentrations in the river nor will it identify spikes in the PCB concentrations within the river flow. If the water from the river is to be used as a source of drinking water again in the future, such monitoring will not eliminate risk

to individuals from future exposures, nor will it provide adequate warning to water plant operators to allow them to switch to an alternate source of water.

With all of the uncertainty associated with the amount of residual PCBs remaining after dredging and the undefined locations of the redeposited sediments, there is no way to accurately predict how effective remediation efforts will be in reducing PCB concentrations in the water of the river. Likewise, there is no way to predict, with any certainty, the time course for the reduction of concentrations as a result of natural flushing. Since PCBs are persistent in the environment, they will likely continue to be a contaminant in the Hudson River for a long time to come. In addition, with the recurring high flow events, it is well understood that PCBs will be redistributed within the river channel, however; the amounts and locations of these PCBs are as yet undetermined.

For the foregoing reasons, the plaintiff municipalities acted reasonably and prudently in making the choice to switch to alternative water supply sources prior to the start of dredging and continuing until the threat of PCB contamination of the water supplies is eliminated. Further, the additional cost for the alternate water supply and the capital improvement expenditures were necessary and prudent to ensure a reliable and safe source of drinking water for the residents of these communities.

APPENDIX 1

Kirk W. Brown, Ph.D.

Biographical Data

Principal Consultant; KW Brown, Environmental Consultant

Born: July 3, 1940; Bethlehem, PA

Citizenship: U.S.A.

Marital Status: Married

No. of Children: 3

Education

Ph.D., Agronomy, University of Nebraska, 1969

M.S., Agronomy/Plant Physiology, Cornell University, 1964

B.S., Agronomy, Delaware Valley College, 1962

Areas of Expertise

Fate and Movement of Salt, Oil, Metals, Organic Chemicals, Gases, Nutrients, Pesticides and Pathogens in Soil, Air and Groundwater Environments; Remediation of Metal and Organic Chemical Contaminated Soils and Groundwater; Leachability and Translocation of Metals and Organic Chemicals in the Soil Profile; Fixation and Stabilization of Metals in the Environment; Characteristics of Hazardous and Municipal Wastes; Industrial Waste Stream Identification; Classification and Fingerprinting of Waste Materials; Disposal of Municipal, Industrial, and Hazardous Waste by Land Treatment and Landfilling; Land Treatment of Sewage Sludge, Industrial Wastewater and Sludge; Bioremediation of Polluted Soils; Vapor Extraction of Soils; Toxicity and Risk-based Assessment of Soil Contaminants to Plants and Animals; Flux of Volatile Chemicals in Air; Air Dispersion Modeling; Influence of Chemicals on the Permeability of Landfill Liners; Sources and Transport of Methane; Composting of Municipal and Hazardous Waste; Design and Operation of Septic Systems; Nonpoint Source Pollution; Expansive Properties of Clay Soils; Soil Solution Sampling; Fate of Mutagenic Compounds in Soil; Mold and Fungal Growth; Reclamation of Drastically Disturbed Lands; Aerial Photo Interpretation; Soil Use and Suitability Classification; Agricultural Water Use Efficiency; Crop Water Stress; Golf Green and Athletic Field Construction; Use of Windbreaks; Soil Crusting; Gas Movement in Soil.

Academic

Professor Emeritus, Soil and Crop Sciences, Texas A&M University, 2001-Present.

Professor, Soil and Crop Sciences, Texas A&M University, 1981-2001.

Associate Professor, Soil and Crop Sciences, Texas A&M University, 1973-1981.

Assistant Professor, Soil and Crop Sciences, Texas A&M University, 1970-1973.

Visiting Scientist, Center of Plant Physiological Research, Wageningen, Netherlands, August, 1969-July, 1970.

Research Assistant, University of Nebraska, June, 1965-December, 1969.

Teaching Assistant, Cornell University, September, 1964-June, 1965.

COURSES TAUGHT

Soil Physics (Undergraduate Course No. 445) 1970-2001.

The practical aspects of soil texture, structure, water management, as well as the theoretical aspects of soil water potentials, and the movement of water, ions, gas, and heat in the soil.

Advanced Soil Physics (Graduate Course No. 617) 1970-1988.

An in-depth study of the physical properties of soil including basic principles which regulate the dynamics of soil, water and ion movement, soil aeration, and soil thermal relationships. Equations describing these processes are presented and references to current literature are provided for outside reading.

Kirk W. Brown

Reclamation of Drastically Disturbed Lands (Graduate Course No. 615) 1979-1986.

Concepts influencing the reclamation, revegetation, and establishment of a stable ecological system on lands that have been drastically disturbed by strip mining, severe erosion, or toxic waste contamination.

Land Disposal of Wastes (Graduate Course No. 616) 1987-2001.

The theoretical and practical aspects of the land treatment and landfilling of a wide range of municipal, industrial, and hazardous wastes. Emphasis has been placed on the fate and mobility of various waste constituents in the soil and the influence of soil physical and chemical properties on constituent fate.

Short Courses Taught

Soil Science Institute (One month course) 1984, 1986, 1992, 1993

Land Treatment of Industrial Waste - Chemical Engineering Society, 1982, 1983.

Landfill Liner Design, University of Texas - 1986, 1987.

Society Memberships

American Society of Agronomy, 1970-2001

Soil Science Society of America, 1970-2001

American Chemical Society, 1970-2001

International Society of Soil Science, 1970-2001

Editorial Board

Environmental Engineering Science, formerly Hazardous Waste and Hazardous Materials. 1989-2001.

Reviewed Papers For

Soil Science Society of America Proceeding; Soil Science, Journal of Environmental Quality; Environmental Engineering Science, formerly Hazardous Waste and Hazardous Materials; ATSDR; American Petroleum Institute; Water, Air & Soil Pollution; Waste Management & Research, Water Pollution Control Federation; Water Research; Waste Management; Journal of Hazardous Materials; Archives of Environmental Contamination and Toxicology.

Elected Positions

Chairman, ASA Section A5, 1989-90

General program chairman for ASA meetings, 1973

Chairman, ASA Section A3, 1972

Committee Appointments

National Academy of Sciences, National Research Council Committee on Environmental Technologies Subcommittee on Landfills (1995-1998).

EPA Review for Risk Assessment for Petroleum Industry Hazardous Waste Listing Determination (Sept 1995).

Environmental Geosciences Advisory Committee of the American Geological Institute representing the Soil Science Society of America (1993-2000).

National Academy of Sciences (NRC) Committee on Remedial Action Priorities for Hazardous Waste Sites (1991-1994).

Texas Natural Resource Conservation Commission Committee on rules on Wastewater Treatment Plant Sludge, Water Treatment Plant Sludge and Septic Tank Sludge Disposal (1992-1993).

Texas Water Commission Committee to Develop Regulations on the Land Application of Sewage Sludge (1992-93).

Faculty of Toxicology Executive Committee, Texas A&M University (1990-93).

Texas Governor's Infrastructure Committee on Free Trade (1991).

Oklahoma Corporation Commission on Land Application of Oil Field Drilling Waste (1990-1991).

Texas Department of Health Ad Hoc Committee for Revising the Construction Standards for On-Site Sewage Facilities (1989-90).

EPA Hazardous Waste Center Review Panel (1988).

Kirk W. Brown

National Science Foundation, Environmental Engineering Div., Review Panel (1987-1995).
Texas Dept. of Health Septic Disposal Regulations Revision Panel (1987).
Advisory Panel to Chicot Aquifer Management Project (Louisiana). McNeese State University, LA (1987-1990).
ASA Editorial Committee "Reaction and Movement of Organic Chemicals in Soils" 1987.
Advisory Panel to U.S. Congressional Office of Technology Assessment (OTA) on An Assessment of the Effectiveness of the EPA in Identifying, Prioritizing and Cleaning Up Hazardous Waste Sites (1987-1995).
Organizing Committee for SSSA Workshop on Utilization, Treatment and Disposal of Waste on Land (1985).
Panel to Write Research Needs for Hazardous Wastes Treatment and Disposal for National Science Foundation. Drexel University, PA (1986).
EPA Technical Advisory Panel on the Adequacy of Ground Water Monitoring at Hazardous Waste Landfills (1985).
Panel to Write the Mutagenicity Sample Preparation Protocol for EPA (1984).
EPA Panel to Review the Acceptability of Landfill Disposal of Sewage Sludge (1984).
Office of Water Regulations and Standards Committee on Municipal Sludge Landfilling to Advise EPA on the Pollutants which should be Regulated for Various Disposal Options and the Methods or Procedures to be Used for Regulating such Pollutants (1984).
Advisory Panel to U.S. Congressional Office of Technology Assessment (OTA) to Determine the Effectiveness of Current Programs to Clean Up Uncontrolled Hazardous Waste Sites (1983-84).
EPA Science Review Panel for Environmental Engineering Research Grants (1982-1998).
United States Environmental Protection Agency Land Treatment Task Force (1981-1985).

Significant Reports Resulting from Committee Assignments

National Research Council. 1999. "Groundwater & Soil Cleanup, Improving Management of Persistent Contaminants".
National Research Council. 1994. "Ranking Hazardous Waste Sites".
Office of Technology Assessment, Congress of the United States of America. 1989. "Coming Clean, Superfund Problems Can be Solved".
Office of Technology Assessment, Congress of the United States of America. 1985. "Superfund Strategy".

University Committees

Texas A&M University Environmental Safety and Health Committee (1987-90).
Council of Principal Investigators, Texas A&M University (1986-1990).
Texas Agricultural Experiment Station 5-Year Planning Board.
Texas A&M University Faculty Forum (1979-82).
Texas Agricultural Experiment Station Grant Support Committee (1976-77).

Awards

Texas A&M University College of Agriculture Award for Excellence in Teaching (1995)
Texas A&M University System Award for Excellence in Graduate Teaching (1988)
ASA Environmental Quality Research Award (1988)
Fellow - Soil Science Society of America (1987)
Fellow - American Society of Agronomy (1986)
Distinguished Alumni Award, Delaware Valley College (1986)
Superior Achievement Award for Research, Soil and Crop Sciences Department, Texas A&M University (1986)
Pollution Engineering Magazine Award of Merit for Outstanding Editorial Contribution "The Case for Aboveground Landfills" (1984)

Books Authored

Hazardous Waste Land Treatment. 1983. Butterworth Publishers, 10 Tower Office Park, Woburn, MA 01801.
Reactions and Movement of Organic Chemicals in Soils. 1989. Sawhney, B. L. and K. W. Brown. SSSA/ASA Publishers, SSSA Special Publication No. 22, 494 pgs.

Professional Experience Outside the United States

Visiting Scientist at Center of Plant Physiological Research, Wageningen (1969-70).

Kirk W. Brown

Testimony Before Legislative Bodies

Texas House of Representatives - Environmental Affairs Committee, April 1987. Testified on the need for legislation to set up a waste management plan for the state.

Texas Governor's Taskforce on Oil Spills, February 1985. Testified on the fate of oil spill debris and disposal technology options.

Texas Governor's Taskforce on Hazardous Waste, November 1984. Testified on the effectiveness of landfills for disposal technology.

Texas Governor's Taskforce on Hazardous Waste, June 1984. Testified on the impact of organic chemicals on the permeability of soils.

U.S. House of Representatives - Science and Technology Committee, November 1982. Testified on the adequacy of EPA's liquid management system to protect groundwater at hazardous waste landfills.

Texas House of Representatives - Environmental Affairs Committee, April, 1982. Testified on the impact of organic chemicals on the permeability of clay liners.

Consulting

Founder and President of K. W. Brown and Assoc., Inc., (1980- 1991). Chief technical consultant to K. W. Brown Environmental Services (1991-1999), SI Group, LP (2000-2009), TTI Environmental Consultants (2009-2011), and as an independent consultant (2011-Present). Past consulting activities have included assignments with Dupont, Alcoa, General Motors Corporation, Minnesota Mining & Manufacturing, WR Grace, Owens Corning, Union Pacific Railroad, Chevron, Shell, Exxon, Texaco, Arco, Sunoco, El Paso Products, New York Attorney General's Office, Illinois Attorney General's Office, Minnesota Attorney General's Office, Minnesota Pollution Control Administration, U.S. EPA, U.S. Army Corps of Engineers, and U.S. Dept. of Justice.

Consulting activities have included consultations on the cleanup and disposal of wastes, the impacts of hazardous waste on the environment, assessment and remediation of exploration and production releases, the design of hazardous waste landfills and solid waste management units, and the fate and mobility of chemicals in the soil, groundwater, and air, as well as, providing expert testimony at permit hearings, mediation hearings, civil suits, and before legislative bodies on these topics. My expertise has been utilized for site assessments, data review and interpretation, the study of fate and transport of contaminants in the environment, waste management activities, historical oilfield and landfill operations, and other related environmental matters. I have reviewed and interpreted a large quantity of analytical data for air, soils and groundwater, as well as boring logs, field logs, technical reports, and other information related to the environmental conditions of a site. I have prepared and reviewed remedial action plans for hundreds of sites including sites contaminated with metals, organic chemicals, pesticides, biological pathogens and petroleum production wastes. I have designed and implemented remedial actions at numerous hazardous waste sites under the auspices of both state and federal regulatory authorities.

As a consultant, I have evaluated or analyzed hazardous substances in industrial waste streams from numerous industries including the lumber and paper industries, the printing industry, chemical manufacturing industry, petroleum exploration, production, processing and refining industries, plastics and rubber products industry, leather tanning and finishing, metal smelting and finishing, electric utilities, and the electronic components manufacturing industry, among others. I have conducted extensive research on the hazardous substances contained in municipal and household waste with a special emphasis on the fate and mobility of these constituents in the environment after disposal in municipal solid waste landfills. I have provided evaluations and assessments for numerous waste disposal and landfill sites including the following: Love Canal Landfill, Lowrey Landfill, Helen Kramer Landfill, Junker Landfill, Lemberger Landfill, Laurel Park Landfill, Beacon Heights Landfill, RCA-Buzby Landfill, Valleycrest Landfill, Boarhead Farms, Pennsauken Landfill, Lone Pine Landfill, Ft. Bend County Landfill, and Sinton Landfill, among others. In addition, I have also provided expert testimony for civil actions involving the following Superfund sites: Hardage Criner, Montana Pole, National Gypsum, Brio/Dixie Oil Processors, Sikes' Pits, Turtle Bayou, Metal Bank of America, Tar Creek, and the West Dallas Lead Site.

Guest Lectures

Dewatering of confined dredge spoil areas. In: *Second International Symposium on Dredging Technology*. BHRA Fluid Engineering, Cranfield, Bedford, England. Paper G1:1-24. (1977).

Kirk W. Brown

Revegetation of drastically disturbed lands. Texas A&M Lignite Symposium. April 17-18. (1980).

Impact of surface mining on water quality. Texas A&M Lignite Symposium, April 17-18, 1980.

Factors influencing the biodegradation of API separator sludges applied to soils. Presented at the Seventh Annual Research Symposium at Philadelphia, PA. March 16-18, 1981.

Land treatment of industrial hazardous wastes. Presented at a Symposium and Workshop on Hazardous Waste Management. Louisiana State University, November 16-20, 1981.

Effect of organic chemicals on clay liner permeability. A review of the literature. Presented at the Sixth Annual Research Symposium at Philadelphia, PA. 1981.

Land disposal of oily wastes. Brest, France. August, 1982.

Influence of organic liquids on the permeability of clay soils. Harwell, Great Britain. July, 1982.

Use of sewage effluent for irrigation. Adelaide, Australia. June, 1982.

Influence of organic liquids on the integrity of liners to pits, ponds, lagoons and landfills. Waste Water Analysts Assoc., Houston, TX. November, 1982

Reclamation of strip mined lands. Sierra Club, Austin, TX. November, 1982.

Waste disposal on range land. Range Science Department, Texas A&M University. College Station, TX. November, 1982.

The politics of hazardous waste disposal. Political Science Department, Texas A&M University. College Station, TX. October, 1982.

The treatment and disposal of hazardous, industrial and toxic waste. American Society of Civil Engineers, Austin, TX. September, 1982.

Effect of organic fluids on the permeability of clay soil liners. Presented at the Eighth Annual Research Symposium at Ft. Mitchell, Ky. March 8-10, 1982.

The fate of mutagenic compounds when hazardous wastes are land treated. Presented at the Eighth Annual Research Symposium at Ft. Mitchell, Ky. March 8-10, 1982.

The influence of chemicals on the permeability of clay liners. Presented at Hazardous Waste Conference, Chicago, Ill. June 28-29, 1983.

Cleanup of chemicals spilled on soils. Presented at the Texas Agricultural Extension Service Conference, Houston, Texas. June 23, 1983.

The reclamation of strip mined land. Presented at Texas Environmental Coalition in Austin, Texas Jan. 22, 1983.

The influence of selected organic liquids on the permeability of clay liners. In: D. W. Shultz (ed). Land Disposal, Incineration, and Treatment of Hazardous Waste. Proceedings of the 9th Annual Research Symposium at Ft. Mitchell, Ky. May 2-4, 1983.

Panel on land treatment of sewage sludge. EPA Workshop on Sewage Disposal, Denver, CO. March 1983.

Land disposal of hazardous liquids. Waste Management Conference, Houston, TX. February 1983.

Alternatives to land disposal of waste. Dept. of Agriculture Seminar, University of Houston. Sept. 10, 1984.

How to write a successful research proposal. Soil Science Graduate Seminar, Soil & Crop Sciences Dept, Texas A&M University, Sept. 19, 1984.

The advantages of above ground disposal. Waste Tech Conference, Houston, October 30, 1984.

Potential groundwater implications of surface storage of toxic substances. Groundwater Symposium, Gunter Hotel, San Antonio, Texas. October 30, 1984.

Clean up of spills; Alternative disposal methods. Geotechnical Engineering for Waste Disposal Symposium, University of Texas, Austin. November 2, 1984.

The properties of soils and containment of waste. Environmental Engineering Seminar, Civil Engineering Dept., Texas A&M University, College Station, 1984.

Carbon dioxide flux at the earth's surface. Texas A&M University, College Station, February 1984.

Above ground landfills in hazardous waste management schemes. National Conference and Exhibition on Hazardous Waste and Environmental Emergencies. Houston, Texas, March 1984.

Fate of mutagens applied to soil. Environmental Toxicology and Pharmacology Seminar. Texas A&M University, College Station, March, 1984.

Permeability of compacted soils to solvents mixtures and petroleum products. Presented at the Tenth Annual Research Symposium at Cincinnati, Ohio, April 1984.

Simulation of Potential Rainfall Conservation from Two Cross-Diked Furrow Bed Designs. Texas A&M University, College Station. February 1984.

Kirk W. Brown

The soil scientist as a consultant. Soil Science Graduate Seminar, Panel Discussion. Soil & Crop Sciences Dept, Texas A&M University, Sept. 12, 1984.

Land disposal of hazardous waste. Agricultural Engineering Dept. Graduate Seminar, Agricultural Engineering Dept., Texas A&M University. Sept. 13, 1984.

Geotechnical engineering for waste disposal projects. University of Austin, Texas, October 1985.

Monitoring the unsaturated zone. Presented at the National Specialty Conference. Land Treatment: A Hazardous Waste Management Alternative, April 16-18, 1985, Austin, Texas.

Ability of sorbents to retain liquids in landfills, 10th Annual American Organization of Analytical Chemists' Spring Workshop, Dallas, Texas April, 9-11, 1985.

Geotechnical engineering for waste disposal projects. University of Austin, Texas, October 1986.

Potential health effects of hazardous waste contaminants in groundwater. Public Health Grand Rounds, University of Pittsburgh Graduate School of Public Health. January 23, 1986.

Geotechnical engineering for waste disposal projects. University of Texas, Austin, October 1986.

Influence of organic liquids on the hydraulic conductivity of soils. University of Cambridge, United Kingdom. September 9-11, 1987.

Design and construction of the growth media in golf greens, Montreal, Canada, 1987.

Groundwater pollution problems associated with fertilizers, pesticides, and leaking storage tanks. Pro Show, Dallas, November 1987.

Mutagenic testing of hazardous waste sites. Southwest Environmental Mutagenic Society, Houston, November 1987.

The use of lime for waste disposal and treatment of hazardous waste contaminated sites. National Lime Association, Phoenix, AZ, April 1987.

A soil scientist as an expert witness - Presented to the Soil Survey and Land Resource Workshop. February 19, 1988.

Guest lecture to Rio Brazos Audubon Society - May 2, 1988.

Presentation to the Texas Association of Milk, Food and Environmental Sanitarians, June, 1988.

Guest lecture to Range Science Ecology and Land Use class. Dept. of Range Science, Texas A&M University, Nov. 18, 1988.

Hazardous Waste: A general overview. Agricultural Engineering, Environmental and Water Resources Engineering and Texas Water Resources Institute Seminar, Texas A&M University, College Station, TX. January 1989.

The need for community recycling. Environmental Organization, Civil Engineering Dept., Texas A&M University, College Station, TX. February 1989.

Superfund sites: The problems and the solutions. Industrial Hygiene Seminar, Texas A&M University, College Station, TX. February 1989.

Hazardous waste disposal on the Gulf Coast Texas. Texas ASA Annual Meeting. Galveston, Galveston County, Texas, February 1989.

New technologies for liners - Presented at the Conference on Prevention and Treatment of Groundwater and Soil Contamination in Petroleum Exploration and Production. Calgary, Alberta, Canada, May 9-12, 1989.

Guest Lecture to Range Science Ecology and Land Use Class: Dept. of Range Science, Texas A&M University, College Station, TX. Oct. 4, 1989.

Ongoing and future research in the geowaste area. Presented to the Geo Waste Group Meeting, Civil Engineering Dept. Texas A&M University, Nov. 1, 1989.

Waste disposal: where do we go from here? Presented to the MSC Great Issues: Environmental Symposia. Texas A&M University, College Station. Nov. 7, 1989.

Innovative technologies from the 1990s in environmental matters. Presentation to South Texas College of Law Environmental Law Symposium, January 17, 1990.

Waste disposal, past, present, and future. Presented at the seminar entitled "Disposing of Hazardous Materials". MSC, Texas A&M University, College Station, TX January 1990.

Panel discussion session at Vertisol Management Workshop: International Collaboration in Research, Training and Extension. Texas A&M University, College Station, June 25-29, 1990.

Municipal waste disposal - where do we go from here. Presentation to Texas Environmental Action Coalition, Texas A&M University, College Station, TX. Sept. 5, 1990.

Presentation to the Texas Section of American Society of Agricultural Engineers, College Station, TX. October 11, 1990.

Kirk W. Brown

- Presentation on golf green construction at Canadian Golf Superintendents Association Conference, Montreal, Canada. Dec. 11, 1990.
- Environmental Soil Science and Technology. Presentation to the 1991 Texas Agric. Experiment Station Conference - Environmental Soil Science Session, College Station, TX. January 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Association of Agricultural Consultants. Austin, Texas, January 21, 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Agricultural Extension Service Conference for Producers, Austin, TX, January 25, 1991.
- Pesticide rinsate disposal options. Presentation to the Research Center Administrators Society meeting, Dallas, Texas February 3-5, 1991.
- Movement of pesticides to groundwater. Presentation to the Texas Agricultural Extension Service Conference for Grounds Keepers. Round Rock, Texas, February 21, 1991.
- Liners for Hazardous Waste Sites. Presented at the Hazardous Waste Management Division's Lecture Series. U.S. Environmental Protection Agency, Region 6, 1445 Ross Ave., Suite 1200, Dallas, TX. 1991.
- Decontamination of polluted soils. Presented at the Second International Conference on the Biogeochemistry of Trace Elements, Taipei, Taiwan, Republic of China. Sept. 5-10, 1993.
- Using plants to reclaim contaminated sites. Crop Science Seminar. Soil & Crop Sciences Dept., Texas A&M University, College Station, TX, October 24, 1994.
- Vadose zone modeling of the fate and movement of volatile contaminants, Geological Society of America, South-central Section Conference, Austin, TX, March 12, 1996.
- Banning of liquid wastes from landfills - development of the technical data and the regulations, South Texas Environmental Conference, Corpus Christi, TX, March 29, 1996.
- The science behind RCRA/CERCLA enforcement (Part II), Science For Environmental Attorneys, Denver CO, November 6, 1997.

Scientific Publications

1. Allen, L. H. and K. W. Brown. 1965. Shortwave radiation in a corn crop. *Agron. J.* 57:575-580.
2. Brown, K. W. and W. Covey. 1966. The energy budget evaluation of the micrometeorological transfer processes within a corn field. *Agri. Meteorol.* 3:73-96.
3. Brown, K. W. and L. J. Wright. 1967. Comparison of momentum and energy balance method of computing vertical transfer within a crop. *Agron. J.* 59:427-432. C701.
4. Brown, K. W. and N. J. Rosenberg. 1968. Errors in sampling and infrared analysis of CO₂ in air and their influence in determination of net photosynthetic rate. *Agron. J.* 60:309-311.
5. Brown, K. W. 1969. A model of the photosynthesizing leaf. *Phys. Plant* 22:620-637.
6. Brown, K. W. and N. J. Rosenberg. 1969. Computer program for plotting time dependent meteorological data. *Agric. Meteorol.* 6:463-464.
7. Brown, K. W. and N. J. Rosenberg. 1970. Concentration of CO₂ in the air above a sugar beet field. *Mo. Weather Rev.* 98:75-82.
8. Brown, K. W. and N. J. Rosenberg. 1970. The influence of leaf age, illumination and upper and lower surface differences on stomatal resistance of sugar beet (*Beta vulgaris*) leaves. *Agron. J.* 62:20-24.
9. Brown, K. W. and N. J. Rosenberg. 1970. The effect of windbreaks and soil water potential on stomatal diffusion resistance and photosynthetic rate of sugar beets (*Beta vulgaris*). *Agron. J.* 62: 4-8.
10. Brown, K. W. and N. J. Rosenberg. 1970. Energy and CO₂ balance of an irrigated sugar beet (*Beta vulgaris*) field in the Great Plains. *Agron. J.* 63:207-213.
11. Brown, K. W. and N. J. Rosenberg. 1970. Shading inverted pyranometers and measurements of radiation reflected from an alfalfa crop. *Water Res. Res.* 6:1782-1786.
12. Rosenberg, N. J. and K. W. Brown. 1970. Improvements in the van Bavel-Myer automatic weighing lysimeter. *Water Res. Res.* 6:1227-1229.
13. Briggs, W. W., A. R. Edison, J. D. Eastin, K. W. Brown, J. W. Marencville, and M. D. Clegg. 1971. Photosynthesis light sensor and meter. *Ecology* 52:125-131.
14. Brown, K. W. and N. J. Rosenberg. 1971. Turbulent transport and energy balance as affected by a windbreak in an irrigated sugar beet (*Beta vulgaris*) field. *Agron. J.* 53:351-355.
15. Brown, K. W. and N. J. Rosenberg. 1971-2. Shelter-effects on micro-climate, growth and water use by irrigated sugar beets in the Great Plains. *Agric. Meteorol.* 9:241-263.

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16. Brown, K. W. and N. J. Rosenberg. 1973. A resistance model to predict evapotranspiration and its application to a sugar beet field. *Agron. J.* 65:341-347.
17. Duble, R. L. and K. W. Brown. 1973. Environmental concerns for the golf superintendent. *USGA Green Section Record*. 11:10-13.
18. Brown, K. W. 1974. Calculations of evapotranspiration from crop surface temperature. *Agric. Meteorol.* 14:199-209.
19. Holder, C. B. and K. W. Brown. 1974. Evaluation of simulated seedling emergence through rainfall induced soil crusts. *Soil Sci. Soc. Amer. Proc.* 38:705-710.
20. Brown, K. W., C. J. Gerard, B. W. Hipp and J. T. Ritchie. 1974. A procedure for placing large undisturbed monoliths in lysimeters. *Soil Sci. Soc. Amer. Proc.* 38:981-983.
21. Rosenberg, N.J. and K. W. Brown. 1974. "Self-checking" psychrometer system for gradient and profile determinations near the ground. *Agric. Meteorol.* 13: 215-226.
22. Spotts, J. W. and K. W. Brown. 1975. A technique for installing induction coils in a profile with minimum soil disturbance. *Soil Sci. Soc. Amer. Proc.* 39: 1006-1007.
23. Jordan, W. R., K. W. Brown and J. C. Thomas. 1975. Leaf age as a determinant in stomatal control of water loss from cotton during water stress. *Plant Physiol.* 56:595-599.
24. Brown, K. W. and R. L. Duble. 1975. Physical characteristics of soil mixtures used for golf green construction. *Agron. J.* 67:647-652.
25. Brown, K. W. 1975. A device for isolating soil columns with minimum disturbance. *Soil Sci. Soc. Amer. Proc.* 39:1008-1009.
26. Brown, K. W. and N. J. Rosenberg. 1975. Annual windbreaks boosts yields. *Crop and Soils Magazine*. p. 8-11. Apr-May, 1975.
27. Brown, K. W. 1976. Chapter II. 3. Sugar beet and potatoes. In: Vegetation and the Atmosphere. (J. L. Monteith, ed.). Academic Press, NY. p. 65-86.
28. Thomas, J. C., K. W. Brown and W. R. Jordan. 1976. Stomatal response to leaf water potential as affected by preconditioning water stress in the field. *Agron. J.* 68:706-708.
29. Deuel, L. E., Jr., K. W. Brown, F. C. Turner, D. G. Westfall and J. D. Price. 1976. Persistence of Propanil, DCA, and TCAB in soil and water under flooded rice culture. *JEQ* 6:127.
30. Brown, K. W., W. R. Jordan and J. C. Thomas. 1976. Water stress induced alteration in the stomatal response to leaf water potential. *Phys. Plant.* 37:1-5.
31. Chaudhari, K. G., K. W. Brown, and C. B. Holder. 1976. Reduction of crust impedance to emergence by the addition of manure. *Soil Sci.* 122:216-222.
32. Deuel, L. E., Jr., F. C. Turner, K. W. Brown and J. D. Price. 1977. Persistence and factors affecting dissipation of molinate under flooded rice culture. *JEQ* 7:373-377.
33. Brown, K. W. 1977. Chapter 19. Shrinking and swelling of clay, clay strength and other bulk properties of clay soils and clays. In Minerals in Soil Environments. (J. B. Dixon and S. B. Weed eds.). Soil Sci. Soc. of Amer., pp. 680-707, Madison, WI.
34. Brown, K. W., R. L. Duble and J. C. Thomas. 1977. Nitrogen losses from golf green, *USGA Green Section Record*. 15:5-7.
35. Brown, K. W., F. C. Turner, J. C. Thomas and M. E. Keener. 1977. Water balance of flooded rice paddies. *J. of Agr. Water Use* 1:277-291.
36. Deuel, L. E. Jr., K. W. Brown, J. D. Price and F. C. Turner. 1977. Persistence of carbofuran and its metabolites, 3-keto and 3-hydroxy carbofuran, under flooded rice culture, *JEQ* 8:23-26.
37. Brown, K. W., R. L. Duble and J. C. Thomas. 1977. Influence of management and season on fate of N applied to golf greens. *Agron. J.* 69:667-671.
38. Brown, K. W. and L. J. Thompson. 1977. Dewatering of Confined Dredge Spoil Areas. Second International Symposium on Dredging Technology. 2-4, November, 1977, Texas A&M University pp. G1-1-G1-24.
39. Shive, J. B. and K. W. Brown. 1978. Quaking and gas exchange in cottonwood (Populus deltoides, Marsh) leaves. *Plant Physiol.* 61: 331-333.
40. Duble, R. L., J. C. Thomas and K. W. Brown. 1978. Arsenic pollution from underdrainage and runoff from golf greens. *Agron. J.* 70:71-74.
41. Duble, R. L., K. W. Brown and J. C. Thomas. 1978. Increase fertilizer efficiency and reduce nutrient loss. *Golf Superintendent* 46:28-31.

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42. Jones, S. G., K. W. Brown, L. E. Deuel and K. C. Donnelly. 1978. Influence of rainfall on the retention of sludge heavy metals by the leaves of forage crops. JEQ 8:69-72.
43. Brown, K. W. and J. C. Thomas. 1978. Uptake of nitrogen by grass from septic fields in three soils. Agron. J. 70:1037-1040.
44. Brown, K. W., D. C. Anderson, S. G. Jones, L. E. Deuel, Jr., and J. D. Price. 1979. The relative toxicity of four pesticides in tap water and water from flooded rice paddies. Int. J. Env. Studies. 141:49-54.
45. Brown, K. W., H. W. Wolf, K. C. Donnelly and J. F. Slowey. 1979. The movement of fecal coliform and coliphage below septic lines. JEQ 8:121-125.
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- "Physiological model of plant growth and development of ecosystem simulation." 1975-1978. Funded by the National Science Foundation for \$129,813. Final Report submitted June, 1978.
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- "Statistical and biophysical modeling of Dendroctonus frontalis-Host tree dynamics: II. Physical models of Dendroctonies frontalis - Host tree systems." 1975-1979. Funded by the USFS-CSRS Expanded Southern Pine Beetle Program for \$174,780. Final Report submitted December, 1979."
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- "To investigate the necessity of a sand layer between the top mixture and gravel layer in golf green construction." 1978-1979. Funded by the United States Golf Association, Greens Section for \$3,220. Final Report submitted March, 1980.
- "To develop a plan to minimize the volume of runoff water which must be treated and disposed of and to assess the feasibility of land disposal of the runoff water and sludge." 1979-1980. Funded by Texas Engineering Extension Service for \$11,058.40. Final Report submitted April, 1980.
- "Investigate the concentration of heavy metals and certain other physical and chemical properties - Gibbons Creek Lignite Mine." 1980. Funded by Texas Municipal Power Agency for \$12,500. Final Report submitted April, 1980.
- "Improved water and nutrient management through high-frequency irrigation." 1977-1980. Funded by Texas Water Resources Institute for \$179,435. Work completed June, 1980.
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- "Root distribution of bermudagrass grown on reclaimed lignite spoil." 1980-1981. Funded by the Center for Energy and Mineral Research for \$12,590. Final Report submitted August, 1981.
- "A residual evaluation of the influence of chemicals on the permeability of soil clays." 1979-1980. Funded by the Environmental Protection Agency for \$91,783. Report submitted December, 1981.
- "Investigate the influence of organic matter quality and placement on the establishment of grass and the physical properties of golf green mixes." 1979-1981. Funded by the U. S. Golf Association, Green Section for \$10,177. Final Report submitted February, 1982.
- "Metal uptake by grasses grown on reclaimed lignite spoils." 1979-1980. Funded by the Center for Energy and Mineral Research for \$13,100.
- "Soil disposal of API pit wastes." 1977-1980. Funded by the Environmental Protection Agency for \$184,104. Final report submitted in 1981.
- "Evaluate subsurface landfarm contamination after long term use." 1980-1981. Funded by the American Petroleum Institute for \$98,530. Final Report published in 1983.
- "The use of bioassays to evaluate the environmental impact of land treatment of hazardous industrial wastes." 1980-1983. Funded by the Environmental Protection Agency for \$383,732. Final Report published in 1985.
- "A review and evaluation of the influence of chemicals on the permeability of soil clays." 1981. Funded by the Environmental Protection Agency for \$339,056. Final report published in 1983.
- "Quantify leak rates through holes in landfill liners" 1983-1985. Funded by Environmental Protection Agency for \$232,769. Final report submitted in 1986.
- "Efficiency of soil core and soil-pore liquid sampling systems". 1983-1985. Funded by Environmental Protection Agency for \$101,766. Final report submitted in 1986.
- "Completion of Field Investigation and an Evaluation of Mechanisms by which Organic Liquids Alter the Permeability of Clay Soils". 1984-1985. Funded by EPA for \$59,000. Final report submitted in 1986.
- "Mobility and Stability of Mutagenic Compounds in Municipal Sewage Sludge Amended Soil." 1984-1986. Funded by Environmental Protection Agency. for \$281,800.
- "Development of a Capillary Wick Unsaturated Zone Pore Water Sampler." 1985-1986. Funded by Environmental Protection Agency for \$236,353.
- "Evaluation of the Thickness of Clay Liners Required to Meet RCRA Requirements". Funded by Environmental Protection Agency. 1987-1989. First year funding \$122,184.
- "Development of a Pesticide Rinse Water Digester". 1986-88. Funded by Texas Water Resource Institute for \$58,000.
- "Determination of the optimum furrow dike size to minimize rainfall runoff". 1985. Funded by Texas Water Resource Institute for \$17,500.
- "In situ vapor extraction of volatile contaminants at Superfund sites" 1987-88. Funded by Texas Water Resource Institute for \$40,000.
- "Development of a comprehensive testing protocol to assess the hazard of an uncontrolled hazardous waste site". 1987-89. Funded by Environmental Protection Agency for \$315,897.
- "Evaluation of the Bacterial Mutagenicity and Chemical Characteristics of Municipal Landfill Leachate". 1988-1990. Sponsored by Texas Water Resource Institute, \$47,500.
- "Bioassay Directed Chemical Characterization of Hazardous Organic Chemicals in Waste Contaminated Environments". Funded by National Institute of Health, 1989-1992, \$422,000.
- "The Use of Short-Term Bioassays to Assess the Human Health Hazard of Uncontrolled Hazardous Waste Sites". Funded by National Institute of Health, 1989-1992, \$607,000.
- "In Situ Bioremediation of Hazardous Substances in the Vadose Zone". Funded by USEPA, 1988-1991, \$341,164.
- "Effectiveness of Multiple Liner Systems for Hazardous Waste Containment Facilities". Funded by USEPA, 1988-1991, \$387,203.
- "The Use of In-Vessel Composting as a Treatment Technology for Hazardous Waste Minimization". Funded by Gulf Coast Hazardous Substance Research Center, June 1, 1991-April 30, 1994, \$107,471.
- "Site Assessment." Funded by NIH for \$334,650 for first 3 years. 1992-1996.
- "Demonstration of the Degradation of Toxic Organics in Composted Municipal Solid Waste." Funded by Texas Water Commission for \$135,000 for two years, 1992-1994.
- "A Preliminary Demonstration of the Use of In-Vessel Composting for Degradation of Waste Propellants." Sponsored by Day & Zimmermann, Inc. 1993. Funds amounted to \$18,138.

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“Water Use Efficiency and Wetting Patterns Associated with Directed Subsurface Irrigation.” Sponsored by Texas-Israel Exchange Program through the Texas Department of agriculture 1995-1996 Funds amount to \$27,770.

APPENDIX 2

COMPREHENSIVE LISTING OF TESTIMONY BY K. W. BROWN

TRIAL TESTIMONY	DATE
25 Cause No. 27-CV-08-1912; <i>State of Minnesota, Plaintiff, v. Associated Medical Assurance Limited, et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE, Oak Grove, and East Bethel Landfills and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff.	10/18/10 10/26/10
24 File No. 62-C7-05-012469; <i>State of Minnesota, Plaintiff, v. Evanston Insurance Co., et al., Defendants</i> in the District Court of Minnesota, Second Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE Landfill and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff.	10/26/09
23 Civil Action No. 02-CV-3830; <i>Agere Systems, Inc., et al., Plaintiffs, vs. Advanced Environmental Technology Corporation, et al., Defendant</i> , in the United States District Court for the Eastern District of Pennsylvania. This case involved the alleged disposal of hazardous wastes at the Boarhead Farms Superfund Site in Bucks County, Pennsylvania. Retained by Handy & Harman Tube Co., Defendant	7/1/08
22 Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved the contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Retained by the Plaintiffs.	9/19-20/07 10/11-12/07
21 Case No. 03-CV-498-CVE-PJC; <i>Jimmy Dale Palmer, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Retained by the Plaintiffs.	7/30/07
20 Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved the contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Retained by the Plaintiffs.	5/1/06
19 Civil Action No. 95-CV-6400L, <i>Seneca Meadows, Plaintiff vs. ECI Liquidating, et al., Defendants</i> in the United States District Court, Western District of New York. This case involved claims against defendants concerning the disposal of hazardous substances in the Tantalio Landfill, Seneca Falls, New York. Retained by the Plaintiff.	6/21/05 to 6/23/05

Comprehensive Listing of Testimony by K. W. Brown

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| 18 | Civil Action No. 01:01-CV-890; <i>Lyondell Chemical Company, et al., Plaintiffs v. Albemarle Corporation, et al., Defendants</i> in the United States District Court for the Eastern District Of Texas, Beaumont Division. This case involved the disposal of waste containing hazardous substances and groundwater contamination at the Turtle Bayou Superfund in Liberty County, Texas. Retained by ExxonMobil, Defendant. | 4/18/05 |
| 17 | Cause No. 03-001121-CV; <i>Joseph Paul Horlen, et al., Plaintiffs, v. Robert S. Smith and Robo Investments, Inc., Defendants</i> in the District Court of Brazos County, Texas, 361 st Judicial District. Case involved the subsurface loss of water from a man-made lake within a residential subdivision and the subsequent undercutting of riverbank along the Brazos River. Retained by the Plaintiffs. | 6/17/04 |
| 16 | Civil Action No. 98-CV-0838S (F); <i>W.R. Grace & Co.-Conn., Plaintiff, V. Zotos International, Inc., Defendant</i> in the United States District Court Western District Of New York. Case involved the disposal of cosmetic waste at the Brewer Road Landfill in Waterloo County, and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff. | 5/17/04 to
5/21/04 |
| 15 | Civil Action No. 95-2097 <i>Interfaith Community Organization, et al., Plaintiffs v. Honeywell International, Inc. et al., Defendants</i> . In the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Plaintiffs. | 1/28/03 to
1/29/03 |
| 14 | Case No. 80-1589; <i>United States of America, Plaintiff, vs. City of Philadelphia, Plaintiff-Intervenor, vs. Union Corporation Metal Bank of America, et al., Defendants, vs. Consolidated Edison Company of New York, et al., Third Party Defendants</i> . In the United States District Court for the Eastern District of Pennsylvania. This case involved claims against the defendants concerning the release of PCBs from the Metal Bank/Cottman Avenue Site to the Delaware River. Retained by the Defendants | 08/29/02 to
09/05/02 |
| 13 | Civil No. N-87-52 (PCD). <i>The B.F. Goodrich Company, et al., Plaintiffs v. Harold Murtha, et al., Defendants v. Risdon Corporation et al., Third Party Defendants</i> . In the United States District Court, District of Connecticut. Case involved characterization of hazardous substances in waste generated by industries, commercial establishments, and municipalities disposed at two landfills in Connecticut, Beacon Heights Landfills and Laurel Park Landfill, which were classified as Superfund sites. Retained by Plaintiffs Beacon Heights Coalition and Laurel Park Coalition. | 01/05/98 to
01/09/98 and
01/12/98 to
01/13/98 |
| 12 | Docket Nos. CV-96-0564091S and CV-96-0564092S; <i>Oxford Tire Supply, Inc., Plaintiff v. Commissioner of the Department of Revenue Services, Defendant</i> . In the Superior Court, Judicial District of Hartford/New Britain at Hartford, Connecticut. Case involved tax issues associated with handling of hazardous materials as defined by Connecticut tax regulation. Primary area of testimony was leaching of hazardous substances from rubber tire waste. Retained by Plaintiffs. | 12/18/97 |

Comprehensive Listing of Testimony by K. W. Brown

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| 11 | Civil Action No. 292CV00674(JBA); <i>The Companies for Fair Allocation Group v. Axil Corporation, et al.</i> In the United States District Court for the District of Connecticut. Case involved question of hazardous waste disposal by the Dynamics Corporation of America (Waring Division) at the Barkhamsted-New Hartford Landfill Superfund site in Barkhamsted, Connecticut. Retained by the Plaintiffs. | 6/13–14/96 |
| 10 | Civil Action No. 93-CV-0090-B; <i>KN Energy, Inc., et al., v. Sinclair Oil Corp., d/b/a/ Little America Refining Co.</i> United States District Court, District of Wyoming. Case involved study of hydrocarbon and metals groundwater plume, which had migrated from the area of a refinery and adjacent terminal to a nearby neighborhood in Wyoming. Work involved study of the origin of the plume. Retained by the Plaintiff. | 6/6/95 |
| 9 | Cause No. CA-94-CI-05270; <i>John Gibson Trustee v. Exxon Corporation.</i> District Court, 225 th Judicial District, Bexar County, Texas. Suit involved claim by property owners adjacent to an old refinery for damages due to contaminant migration onto their property from previous waste disposal operations at the closed refinery. Retained by the Defendant. | 2/17/95
2/21/95 |
| 8 | Docket No. N-87-52 (PCD), All Cases; <i>The B.F. Goodrich Company, et al., Plaintiffs v. Harold Murtha, et al., Defendants v. Risdon Corporation et al., Third Party Defendants.</i> United States District Court for the District of Connecticut. Suit concerning the hazardous nature of waste disposed at the Beacon Heights Landfill Superfund site. Retained by the Plaintiff. | 12/15–19/94 |
| 7 | Case No. 390-37213-SAF-11 and Case No. 390-37214-SAF-11, jointly administered Chapter 11; In re: <i>National Gypsum Company v. Aancor Holdings, Inc.</i> Suit involved groundwater contamination associated with Rolling Knolls Landfill. Retained by the U.S.A. | 5/18–20/92
6/1/92
6/24/92 |
| 6 | Case No. CIV-86-1401-P; <i>The United States of America v. Royal N. Hardage, et al., Advance Chemical Company, et al., v. ABCO, et al.</i> United States District Court for the Western District of Oklahoma. Enforcement of ROD concerning remediation of hazardous waste site. Retained by the Plaintiff. | 10/27/89 |
| 5 | <i>The United States of America, the State of New York, and UDC-Love Canal, Inc., v. Occidental Chemical Corp., Occidental Chemical Holding Corp., Occidental Petroleum Investment Co., Occidental Petroleum Corp., City of Niagara Falls, Niagara County Health Department, and the Board of Education of the City of Niagara Falls, Love Canal Landfill Superfund site.</i> United States District Court for the Western District of New York. Testimony on the mobility of organic pollutants through clay. Retained by the Plaintiff. | 3/20–21/89 |
| 4 | Case No. 85-17210-C; <i>James L. Slaughter, et al., v. Farm and Home Savings, et al.,</i> and Case No. 86-48352; <i>Mike Fenimore, et al., v. Farm and Home Savings.</i> 151 st Judicial District Court of Harris County, Texas. Case involved issues of land development and exposure to petrochemical wastes by residents in neighborhoods adjacent to the Brio/Dixie Oil Processors Superfund sites (Houston, Texas). Retained by the Plaintiffs. | 12/6/89 |
| 3 | <i>Barbara Lips v. Jacobs Oil Company.</i> Federal District Court in Corpus Christi. Testimony on the damages and reclamation results from oilfield drilling mud wastes. Retained by the Plaintiff. | 1985 |

Comprehensive Listing of Testimony by K. W. Brown

- 2 *Blair v. Palmer Oil*. Texas District Court. Suit over the destruction of land resulting from oil exploration activities. (587091018) Retained by the Plaintiff.
- 1 *Jarvis L. Smoak v. Arkansas Louisiana Gas Company*. In the Texas District Court of Marshall, Texas. Contamination of soil and loss of trees due to oil spill. Retained by the Defendant.

Comprehensive Listing of Testimony by K. W. Brown

DEPOSITION TESTIMONY

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| 83 | Cause No. 3:08-CV-00229; <i>Natural Resource Defense Council, et al., Plaintiffs, v. County of Dickson, Tennessee, et al., Defendants</i> in the United States District Court for the Middle District of Tennessee. Case involved the contamination of groundwater by contaminants disposed of in the Dickson County Landfill. | 9/22/10 |
| 82 | Cause No. 08-CV-0161; <i>Mary Ellen Hall, et al., Plaintiffs, v. Radiator Specialty Co., et al., Defendants</i> in the District Court of Galveston County, Texas, 212 th Judicial District. Case involved the exposure to benzene from historical emissions from the Union Carbide Chemical Co. facility in Texas City, Texas. Retained by the Plaintiffs. | 12/15/09 |
| 81 | Cause No. 27-CV-08-1912; <i>State of Minnesota, Plaintiff, v. Associated Medical Assurance Limited, et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE, Oak Grove, and East Bethel Landfills and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff. | 10/28/09 |
| 80 | Cause No. E-178,440; <i>Darla J. Lemaire, Individually and as the Independent Executrix of the Estate of Michael Lemaire, Deceased; and Logan Lemaire, Plaintiffs, vs. Berryman Products, Inc, et al., Defendants.</i> In the District Court of Jefferson County, Texas 172 nd Judicial District. Retained by the Plaintiffs. | 9/17/09 |
| 79 | Cause No. GN-401028; <i>Sotero Carrillo, Jose Carmen Carrillo, Miguel Cruz, and Greg Fuller Plaintiffs v. Reichold, Inc., Defendants, Zurich American Insurance Co., Intervenor.</i> In the District Court of Travis County, Texas 98 th Judicial District. Retained by the Plaintiffs. | 2/21/08 |
| 78 | File No. 62-C7-05-012469; <i>State of Minnesota, Plaintiff, v. Evanston Insurance Co., et al., Defendants</i> in the District Court of Minnesota, Second Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE Landfill and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff. | 11/7/07 |
| 77 | Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I .DuPont de Nemours and Company, et al., Defendants,</i> in the Circuit Court of Harrison County, West Virginia. This case involved the contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Retained by the Plaintiffs. | 4/30-5/1/07 |
| 76 | Civil Action No. 02-CV-3830; <i>Agere Systems, Inc., et al., Plaintiffs, vs. Advanced Environmental Technology Corporation, et al., Defendant,</i> in the United States District Court for the Eastern District of Pennsylvania. This case involved the alleged disposal of hazardous wastes at the Boarhead Farms Superfund Site in Bucks County, Pennsylvania. Retained by Handy & Harman Tube Co., Defendant | 12/1/06 and
1/29/07 |

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75	Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved the contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Retained by the Plaintiffs.	1/25-26/06 and 2/10/06
74	Cause No. 02-4162 JPG; <i>Chevron Environmental Management Company, Chevron Environmental Services Company, and Texaco Inc., Plaintiffs, v. Indian Refining I Limited Partnership (f/k/a Indian Refining Limited Partnership), et al, Defendants</i> in the United States District Court for the Southern District of Illinois. Case involved remediation and allocation of costs for the former Indian refinery in Lawrenceville, IL. Retained by the Plaintiff	8/3/05
73	Cause No. 02-4162 JPG; <i>Chevron Environmental Management Company, Chevron Environmental Services Company, and Texaco Inc., Plaintiffs, v. Indian Refining I Limited Partnership (f/k/a Indian Refining Limited Partnership), et al, Defendants</i> in the United States District Court for the Southern District of Illinois. Case involved remediation and allocation of costs for the former Indian refinery in Lawrenceville, IL. Retained by the Plaintiff	6/2/05
72	Civil Action No. 95-CV-6400L, <i>Seneca Meadows, Plaintiff vs. ECI Liquidating, et al., Defendants</i> in the United States District Court, Western District of New York. This case involved claims against defendants concerning the disposal of hazardous substances in the Tantalo Landfill, Seneca Falls, New York. Retained by the Plaintiff.	5/27/05
71	File No. C7-0310992; <i>State of Minnesota, Plaintiff, v. American Hardware Mutual Insurance Company, Defendants</i> in the District Court of Minnesota, Tenth Judicial District. Case involved the disposal of hazardous substances with industrial waste at Oak Grove and East Bethel Landfills and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff.	4/21/05
70	Case No. 03-CV-327 (H) M; <i>Betty Jean Cole, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Retained by the Plaintiffs.	12/7/04
69	Case No. 03-CV-327 (H) M; <i>Betty Jean Cole, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Retained by the Plaintiffs.	10/22/04

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| 68 | Civil Action No. 01:01-CV-890; <i>Lyondell Chemical Company, et al., Plaintiffs v. Albemarle Corporation, et al., Defendants</i> in the United States District Court for the Eastern District Of Texas, Beaumont Division. This case involved the disposal of waste containing hazardous substances and groundwater contamination at the Turtle Bayou Superfund in Liberty County, Texas. Retained by ExxonMobil, Defendant. | 7/8/04 |
| 67 | Court File No. CT 02-016741; <i>State of Minnesota, by its Attorney General, Mike Hatch, Plaintiff, v. American Hardware Mutual Insurance Co., et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE and St. Augusta Landfills and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff. | 2/24/04 |
| 66 | Civil Action No. 98-CV-0838S (F); <i>W.R. Grace & Co.-Conn., Plaintiff, V. Zotos International, Inc., Defendant</i> in the United States District Court Western District Of New York. Case involved the disposal of cosmetic waste at the Brewer Road Landfill in Waterloo County, and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff. | 2/12/04 |
| 65 | Case No. 00-01917 MRP (MANx); <i>Shell Chemical Co., et al., Plaintiffs, vs. The County of Los Angeles, et al., Defendants</i> in the United States District Court for the Central District of California; Case No. 00-1938 MRP (MANx); <i>Phillips Petroleum Co., et al., Plaintiffs, vs. The County of Los Angeles, et al., Defendants</i> in the United States District Court for the Central District of California; and Case No. 00-6420 MRP (MANx); <i>Atlantic Richfield Co., et al., Plaintiffs, vs. BKK Corporation, et al., Defendants</i> in the United States District Court for the Central District of California. These combined cases involved hazardous substances associated with municipal solid waste being deposited at Cal Compact Landfill. Retained by the Plaintiffs. | 3/7/03 |
| 64 | Court File No. MC00-001819; <i>State of Minnesota, by its Attorney General, Mike Hatch, Plaintiff, v. Employers Insurance of Wausau, A Mutual Company, et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the disposal of hazardous substances with industrial waste at the Oak Grove Landfill and East Bethel Landfill in Anoka County, and the contamination of groundwater as a result of these disposal practices. For the Plaintiff. | 12/17/02 |
| 63 | Case No. 80-1589; <i>United States of America, Plaintiff, vs. City of Philadelphia, Plaintiff-Intervenor, vs. Union Corporation Metal Bank of America, et al., Defendants, vs. Consolidated Edison Company of New York, et al., Third Party Defendants</i> in the United States District Court for the Eastern District of Pennsylvania. This case involved claims against the defendants concerning the release of PCBs from the Metal Bank/Cottman Avenue Site to the Delaware River. Retained by the Defendants | 5/28/02 |
| 62 | Civil Action No. H-98-0408 <i>United States of America, et al. vs. Atlantic Richfield Company, et al vs. Ashland, Inc., et al.,</i> in the United States District Court Southern District of Texas Houston Division. This case involved claims against defendants concerning waste disposal at Sikes Pit. Retained by ExxonMobil, Defendant. | 6/26/01 -
6/27/01 |

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61	Civil Action No. 95-2097 <i>Interfaith Community Organization, et al. v. Honeywell International, Inc. et al.</i> , in the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants.	6/20/01
60	Civil Action No. 5:97CV00894; <i>United States of America v. Chrysler Corp. et al.</i> , in the in the United States District Court for the Northern District of Ohio. This case involved claims against the defendants concerning disposal of hazardous substances in the Krejci Dump Site. Retained by Minnesota Mining Manufacturing Company, Defendant.	06/07/01
59	Civil Action No. G-96-493; <i>Janie Rivas, et al., vs. Monsanto Company, et al.</i> , in the United States District Court for the Southern district of Texas Galveston Division. This case involves modeling of emissions and air dispersion of hazardous substances emanating from petrochemical wastes processed and disposed of at the Brio/Dixie Oil Processors Superfund Sites in Houston, Texas and related exposures to children in adjacent neighborhoods. Retained by the Plaintiffs.	03/16/01
58	Case No. CIV-91-2067-PHX-PGR <i>Maurice McIntire, et al. vs. Motorola, Inc.</i> , in the United States District Court in and for the District of Arizona. This case involved a lawsuit by certain Phoenix residents concerning the VOC groundwater and ambient air plumes perpetrated by Motorola and the subsequent exposure of the litigants to the hazardous substances. This deposition involved waste management and waste handling.	5/31/00 - 6/2/00
57	Case No. 98-CV0726 <i>Connie Lolley Klostermann, et al vs. Ultramar Diamond Shamrock Corporation, et al.</i> , in the 212 th Judicial District Court, Galveston County, Texas. This case involved a lawsuit by the landowner concerning property damage resulting from leaking storage tank contamination. Retained by Diamond Shamrock, Defendant.	5/26/00
56	Case No. 97-6222 MRP (MANx) <i>Commercial Realty Projects, Inc., and L.A. Metromall LLC, vs. Atlantic Richfield Company, et al.</i> , in the United States District Court in for the Central District of California. This case involved hazardous substances associated with municipal solid waste being deposited at Cal Compact Landfill. Retained by the Defendants.	3/6/00
55	Case No. 93-055257 <i>Ralph L. Nichols, Jr., et al. vs. Monsanto Company, et al.</i> , in the 125 th Judicial District Court of Harris County, Texas. This case involved contaminant migration via air, surface water, and groundwater media from the Dixie Oil Processors Superfund Site to adjacent athletic field. Retained by the Plaintiffs.	1/28/00
54	Case No. CIV-91-2067-PHX-PGR <i>Maurice McIntire, et al. vs. Motorola, Inc.</i> , in the United States District Court in and for the District of Arizona. This case involved a lawsuit by certain Phoenix residents concerning the VOC groundwater and ambient air plumes perpetrated by Motorola and the subsequent exposure of the litigants to the hazardous substances.	12/6/99 - 12/8/99

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53	Case No. 89-4340 (JBS) <i>United States vs. Helen Kramer et al.</i> , In the United States District Court for the District of New Jersey. This case involved hazardous substance deposition into Kramer Landfill (Superfund Site) by defendants. Retained by lawyers for the plaintiff.	10/6/99
52	Case No. 92-034865; <i>James E. Barnet, Sr., et al., vs. Monsanto Company, et al.</i> In the District Court of Harris County, Texas, 80 th District Court. This case involved former workers' claims concerning exposure to hazardous chemicals. Retained by the Plaintiffs.	4/28/99
51	Case No. 95C-1065; <i>Lemberger Sites Remediation Group, Plaintiff, v. A.M. Richter & Sons Co., et al., and White Consolidated Industries, Inc., Defendants</i> ; In the United States District Court Eastern District of Wisconsin. This case involved hazardous constituents in waste going to Lemberger Landfill (Superfund Site). Retained by the Plaintiff.	3/12/99
50	Case No. 98-459-A; <i>Lewie Byers; vs. Texaco Exploration and Production Inc. and Texaco Inc.</i> In the District Court of Smith County, Texas 7 th Judicial District. This case involves claims of contamination due to releases of crude oil and fluids from oil field production activities. Retained by the Defendant.	1/22/99
49	C.A. No. G-96-493; <i>Janie Rivas, et al., vs. Monsanto Company, et al.; Defendant.</i> In the United States District Court for the Southern district of Texas Galveston Division. This case involves modeling of emissions and air dispersion of hazardous substances emanating from petrochemical wastes processed and disposed of at the Brio/Dixie Oil Processors Superfund Sites in Houston, Texas and related exposures to children in adjacent neighborhoods. Retained by the Plaintiffs.	12/30/98
48	Cause No. 95-044151; <i>Rebecca Johnson, et al., and On Behalf of All Those Similarly Situated, Plaintiffs, vs. Exxon Company, U.S.A., et al., Defendant.</i> In the 61 st Judicial District Court, Harris County, Texas. Case involved claims of contamination to a neighborhood near Carver Elementary school that was built over covered pits where oil began to surface in 1995. Retained by the Defendant.	7/24/98
47	Case 75524; <i>Clarice Friloux, et al., Plaintiffs, vs. Campbell Wells Corporation, et al., Defendants.</i> In the 17 th Judicial District Court, Parish of Lafourche, Louisiana. Case involved claims of offsite air migration of hazardous substances purportedly associated with a non-hazardous oilfield waste disposal facility. Retained by the Defendants.	5/21/98
46	Case No. 93-004644; <i>Mike Adalis, et. al., Plaintiffs, vs. Neighborhood Development Corporation, et al, Defendants.</i> In the District Court of Harris County, Texas, 269 th Judicial District. Case involved claims of groundwater and related drinking water well contamination attributable to 50 year old oil well blowout. Retained by the defendant Exxon.	2/13/98 and 7/8/98

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| 45 | Civil Action No. 95-514875-CE; <i>Grand Trunk Western Railroad, Incorporated and Star Oil Company, Inc., Plaintiffs vs. Union Oil Company of California, Wynkoop Oil Company, Clement Wynkoop, Secory Oil Company and Lewis Secory, Defendants and Union Oil Company and Clement Wynkoop, Counter-Plaintiffs/Cross-Plaintiffs vs. Secory Oil Company and Lewis Secory</i> . Case involved modeling of the transport and fate of hydrocarbon fuels, which leaked from storage, tanks at a terminal and allegedly migrated onto adjoining properties of plaintiffs. Retained by the Defendants. | 5/22/97 and
6/2/97 to
6/3/97 |
| 44 | Case No. 93-03044, <i>James W. Allen, III and Victoria Ann Allen, et al. Monsanto Company, et. al.</i> , and Case No. 93-14478, Christopher Irwin and Jon H. Moore, et al., in the District Court of Harris County, Texas, 113 th Judicial District. Case involved contaminant migration via air, surface water and groundwater media from the Dixie Oil Processors Superfund Site to adjacent children's athletic field. Retained by the Plaintiffs. | 5/13/97 |
| 43 | Civil Action 96C19S; <i>Junker Landfill v. United Waste</i> . In the U.S. District Court, Western District. Case involved study of hazardous substances in wastes generated by approximately 500 generators taken to Junker Landfill (Superfund Site). Retained by Plaintiffs. | 2/28/97 |
| 42 | Cause No. A99,534; <i>Joann McKnight Lambert v. Melvin B. Etheredge, et al.</i> In the 70th District Court, Ector County, Texas. Case involved study of subsurface moisture condition and moisture migration through house slab. Retained by Plaintiff, Lambert. | 1/29/97 |
| 41 | Case No.: 2:92-CV-111; <i>Commercial Union Insurance Co., et. al., v. Cannelton Industries, Inc.</i> , In the United States District Court for the Western District of Michigan. Case involved claim against insurance company for environmental remediation cost recovery associated with chromium contamination of St. Marys River due to a fire at an old tannery plant. Retained by Defendant. | 9/5/96 |
| 40 | Civil Action No. BC015575; <i>Atlantic Richfield Company and ARCO Chemical Company v. Aetna Casualty and Surety Company of America, et. al.</i> ; Superior Court of the State of California for the County of Los Angeles. Case involved disputed claims for insurance coverage of environmental contamination at old refinery sites at Sand Springs, Oklahoma, and Prewitt, New Mexico. Retained by the Plaintiffs. | 4/9/96 -
4/10/96 |
| 39 | Civil Action No. 92-2-28065-5; <i>Aluminum Company of America and Northwest Alloys, Inc. v. Accident and Casualty Insurance Company, et al.</i> Superior Court of the State of Washington, In and For the County of King. Case involved disputed claims for insurance coverage of environmental contamination at three aluminum-manufacturing facilities across the country, and entailed extensive interpretation of historical aerial photographs of the facilities. Retained by the Plaintiffs. | 2/5/96 |
| 38 | Civil Action No. 87-4263(JHR); <i>General Electric Company v. Buzby Brothers Materials Handling Company, et al.</i> United States District Court for the District of New Jersey. Case involved recovery from commercial and municipal transporters of wastes of the costs for remediation of groundwater contamination at the site of the RCA-Buzby Landfill (Superfund Site) near Voorhees, New Jersey. Retained by the Plaintiff. | 11/29/95
6/13-14/96 |

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37	Civil Action No. 85-17210-G; <i>David L. Smithson et al., v. Monsanto Company, et al.</i> , District Courts, 11th Judicial District, Harris County, Texas; and Civil Action No. 93-045095; <i>Thuy Thi Diep, et al., v. Monsanto Company, et al.</i> ; District Court, 55 th Judicial District, Harris County, Texas. These consolidated cases involved the Brio Superfund Site and exposure of adjacent residents to hazardous chemicals in an old waste disposal site through air, soil, groundwater, surface water and drinking water pathways. Retained by Plaintiffs.	11/8/95
36	Case No. 94-C-1025; <i>City and County of Denver et al., v. Alumet et al.</i> United States District Court for the District of Colorado. Case involving the Lowry Landfill Superfund site in Denver, Colorado, and the apportionment of remediation costs due to contamination from co-disposal of municipal and industrial wastes. Retained by the Defendants.	8/17/95
35	Cause No. 15,527; <i>Gary David Harding et al., v. Browning-Ferris Industries, Inc., et al.</i> , District Court, 229 th Judicial District, Duval County, Texas. Case involving personal injury and property damage from industrial waste migration from a landfill. Retained by the Plaintiffs.	6/22/95
34	Case No. 93-03674-CA; In Re: <i>Hipps Road Litigation</i> . Circuit Court of the Fourth Judicial Circuit In and For Duval County, Florida. Suit regarding contamination of drinking water wells from hazardous waste leaking from a landfill. Retained by the Plaintiffs.	5/26/95
33	Cause No. 94-1499-A; <i>Ardith Cavallo, et al., v. Star Enterprise, et al.</i> United States District Court for the Eastern District of Virginia; Alexandria Division. Retained by the Defendant.	5/5/95
32	Case No. CJ-92-3515-62; <i>N.C. Corff Partnership, Ltd., et al., v. Oxy USA, Inc.</i> Oklahoma County District Court. Retained by the Defendant.	4/26/95
31	Civil Action No. 93-CV-0090-B; <i>KN Energy, Inc. et al., v. Sinclair Oil Corporation, d/b/a/ Little America Refining Co.</i> United States District Court, District of Wyoming. Retained by the Plaintiff.	4/19/95
30	Cause No. CV-90-75-BU-PGH; <i>Atlantic Richfield Co. v. Torger L. Oaas et al.</i> , United States District Court for the District of Montana, Butte Division. Retained by the Plaintiff.	11/7/94 11/11/94
29	Cause No. 92-032723; <i>Clear Creek Independent School District v. Farm & Home Savings Association, et al.</i> , District Court 11 th Judicial District, Harris County, Texas. Retained by the Plaintiffs.	10/5/94
28	Cause No. CW 93-39-BU-PGH; <i>Montana Resources, Inc. and Dennis R. Washington v. Atlantic Richfield Company</i> . United States District Court for the District of Montana, Butte Division. Retained by the Defendants.	9/9/94
27	Cause No. 31,692-S; <i>Frank J. Kramr, Individually and as Parents and next friends of Sarah Kramr, a minor, v. Eastern Pipeline Company</i> . District Court 329 th Judicial District, Wharton County, Texas. Retained by the Plaintiffs.	9/7/94

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26	Cause No. 85-17210-G; <i>Gary L. Abel, et al., and David L. & Angell R. Smithson v. Monsanto, et al.</i> District Court 151 st Judicial District, Harris County. Suit concerning the Brio Superfund site. Retained by the Plaintiffs.	5/18/94
25	Case No. 92-CI-15104; <i>Lionel Laguna and wife, Celia Laguna v. Exxon Corporation United States of America.</i> District Court, 57th Judicial District, Bexar County, Texas. Retained by the Defendant.	12/10/93
24	Civil Action No. SA-92-CA-0616; <i>Jesse Sherrod, et al., v. U.S.A.</i> Western District Court of Texas, San Antonio Division. Suit regarding the alleged leakage of chlorinated solvents from an air force base to surrounding areas. Retained by the Plaintiffs.	4/9/93
23	Case No. 390-37213-SAF-11 and Case No. 390-37214-SAF-11, jointly administered Chapter 11; In re: <i>National Gypsum Company v. Aancor Holdings, Inc.</i> Retained by the U.S.	6/24/92 4/26–27/92 5/18–20/92
22	Cause No. 85-17210-F; <i>Andrea Acosta, et al., v. Farm & Home Savings Association.</i> District Court of Harris County, Texas. Suit concerning Brio (Houston, Texas) Superfund site. Retained by the Plaintiffs.	5/13/92
21	Civil Action No. CIV-91-655-W; <i>Larry and Judy Bentley v. Koch Gathering Systems, Inc.</i> Suit concerning the remediation of an oil spill. Retained by Koch.	2/21/92 1/16/92
20	Cause No. 90C0468; <i>Billy White, et. al., v. BP Chemicals, Inc. et. al.,</i> District Court of Brazoria County, Texas.	1/7/92
19	File No. 3-90-312; <i>Kenneth M. Anderson as Personal Representative of the Estate of Fred W. Hedberg v. City of Minnetonka et al.</i> United States District Court for the District of Minnesota, Third Division. Retained by the Plaintiff.	7/16/91
18	Consolidated Civil Action No. 83-C–2379; <i>United States of America v. Shell Oil Company</i> , consolidated with Civil Action No. 89–C–1646, <i>United States of America v. State of Colorado.</i> U.S. District Court for the State of Colorado. Retained by the U.S.A.	4/22–23/91
17	Case No. 485,475; <i>Billy Fred Platt and Paula Kay Callahan v. Bio-Gro Systems, Inc. and the City of Austin.</i> 353 rd District Court, Travis County, Texas. Contamination to soil resulting from sewage sludge application. Retained by Mr. Platt.	3/28/91
16	Cause No. C88-0190-B consolidated with C89-0153-B; <i>Sinclair Oil Corporation v. James S. Scherer, et al., and United States of America v. Sinclair Oil Corporation.</i> United States District Court for the District of Wyoming. Suit concerning alleged contamination from refinery operations. Retained by the United States.	4/27/90
15	Case No. 63,993; <i>Lawrence and Verna Postier v. Laidlaw Waste Systems, Inc., et. al.,</i> 240 th Judicial District Court for Fort Bend County, Texas. Personal injury as a result of methane gas migration from a landfill. Retained by the Plaintiff.	1/9/90 12/21/89

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14	Cause No. 1-88-0141-W; <i>Watts and wife v. Koch Gathering Systems, Inc.</i> United States District Court, North Texas Division, Abilene. Suit concerning land damages resulting from an oil spill. Retained by Koch.	8/23/89
13	<i>The United States of America, the State of New York, and UDC-Love Canal, Inc., v. Occidental Chemical Corp., Occidental Chemical Holding Corp., Occidental Petroleum Investment Co., Occidental Petroleum Corp., City of Niagara Falls, Niagara County Health Department, and the Board of Education of the City of Niagara Falls, Love Canal Landfill.</i> United States District Court for the Western District of New York. Deposition on the mobility of organic pollutants through clay. Retained by the Plaintiff.	3/20–21/89
12	Case No. 85-17210-C; <i>James L. Slaughter, et al., v. Farm and Home Savings, et. al.,</i> and Case No. 86-48352; <i>Mike Fenimore, et al., v. Farm and Home Savings.</i> 151 st Judicial District Court of Harris County, Texas. Damages and clean-up of Brio (Houston, Texas) Superfund site. Retained by the Plaintiffs.	1/13/89 11/11/88
11	Case No. CIV-86-1401-P; <i>The United States of America v. Royal N. Hardage, et al., Advance Chemical Company, et al., v. ABCO, et al.</i> United States District Court for the Western District of Oklahoma. Enforcement of ROD concerning remediation of hazardous waste site. Retained by the Plaintiff.	6/13/88 12/2/88
10	Case No. H-86-2629; <i>United States of America v. International Shoe Company.</i> RCRA compliance for solvent waste surface impoundment. Retained by the U.S.A.	3/5/88
9	<i>Joseph Edward Powell, et al., v. Pulte, et. al.,</i> District Court of Harris County, Texas. Vol. 1 No. 84-75865.	11/11/88
8	Case No. M-85-191-CA; <i>Sammy C. McElroy and wife, Kathleen Ann McElroy v. Getty Oil Company and Texaco, Inc.</i> United States District Court for the Eastern District of Texas, Marshall Division; and Case No. CA-93-54; <i>Sammy C. McElroy and wife, Kathleen Ann McElroy v. Halliburton Company.</i> District Court In and For Panola County, Texas. Fish kill resulting from acid drainages from dried pond bottom mud. Retained by the Defendant.	9/5/86 11/7/86
7	Case No. 84-1112-A; <i>Gary L. Overstreet and Glenda Ann Overstreet v. Texas Oil and Gas Corporation and Delhi Gas Pipeline Corporation.</i> 14 th Judicial District Court of Dallas County, Texas. Suit concerning alleged sulfur contamination of soil, forage, and its potential impact on the productivity of dairy cattle. Retained by the Defendant.	5/2/86
6	Case No. 86-6-8186; <i>Mobil Producing Texas and New Mexico v. Burr Stafford, et al.</i> 24 th Judicial District Court In and For Jackson County, Texas. Testimony on the damages to soil and crops caused by oil production activities. Retained by the Plaintiff.	3/11/86
5	Case No. 83-CV-1116; <i>Clifford and Sandra Schiesl, et al., and Orrin Hagen v. Uniroyal, Inc., and Waste Management of Wisconsin, Inc. v. City of Stoughton, et al., v. Richard H. Sundby, et al.</i> Circuit Court for the State of Wisconsin, Dane County. Contribution of municipal waste constituents to ground water contamination of the Hagen Landfill (Superfund Site) in Dane County, Wisconsin. Retained by Uniroyal.	10/17/86

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- 4 *Bagwell Greenhouse v. Ball Seed Company*. Suit over loss of crops due to contaminated plant growth mixture. Retained by the Defendant.
- 3 *French v. Voluntary Purchasing Groups, Inc.* Suit over the loss of cattle and the contamination of pasture land with arsenic. Retained by the Defendant.
- 2 *Rader and Carpenter v. Texas-New Mexico Pipeline Company*. Damage to soil, trees, and pasture due to oil spill down creek channel. Retained by the Defendant. 3/11/88
- 1 *Stronglite Products Company v. Frit Industries*. Suit over the sale of products that contaminated plant growth mixture. Retained by the Plaintiff.

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REGULATORY HEARING TESTIMONY

26	Testimony at a hearing of the South Carolina Department of Health and Environmental Protection regarding the GSX landfill. Retained by the Opposition.	3/93 2/93
25	In the matter of the application of the North Texas Municipal Water District to Amend Solid Waste Permit No. 568A	2/15/93
24	Testimony at a hearing on a proposed permit amendment regarding the City of McKinney (TX) Landfill. Retained by the Opposition.	1/27/93
23	Testimony at hearings of the Public Utility Commission of Texas regarding the Lon C. Hill-Coleto Creek 345 kv Transmission Line. Retained by the Applicant.	6/1/92 5/92 1990
22	Testimony at a hearing to review an amendment to expand the City of Waco (TX) Landfill. Retained by the Opposition.	1/23/91
21	Testimony at hearing regarding the siting of the Cherokee County Landfill (TX) near an aquifer recharge area. Retained by the Opposition.	9/21–22/88
20	Testimony at permit hearing regarding the Green Valley Environmental Corporation Landfill in Greenup County, Kentucky, regarding suitable siting criteria for a landfill. Retained by opposing parties Clarence Clay, Janet Brown, et. al.	9/88
19	Application of Metropolitan Waste Systems for a Landfill.	7/27/88
18	Application of Laidlaw Waste Systems, Inc. before the Regional Pollution Control Facility Siting Committee of the McHenry County Board.	6/17/87
17	Testimony at a hearing of the Wayne County Board of Commissioners (IL) on operation and maintenance of landfills and associated problems that can impact the environment.	7/15–18/86
16	Testimony at a hearing of the McHenry County Board of Commissioners (IL) on the siting of a proposed landfill. Retained by the Opposition.	12/22/85
15	Testimony at a hearing to review a Browning-Ferris Industries municipal landfill (TX) permit application. Retained by the Tri-County Civic Association.	11/9/83
14	Testimony at an administrative hearing in Illinois on the criteria to be used to ban organic chemicals from landfills.	11/1/83
13	Testimony at hearings held by the Texas Railroad Commission regarding the Texas Municipal Power Agency. Retained by TMPA.	1980
12	Testimony at a permit hearing regarding a proposed Chemical Waste Management landfill in Lake Charles, Louisiana.	1978
11	Testimony at EPA hearing on Chemical Waste Management Part B application for hazardous waste site at Elmiel, Alabama. Comments on permit deficiencies. Retained by the Opposition.	

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- 10 Testimony at an administrative hearing on the location of a Florida landfill in deep sandy soils. Retained by Citizens for a Clean Environment.
- 9 Testimony at a hearing on the State of Florida's alternative landfill liner designs. Retained by MFM Environmental.
- 8 Testimony at a hearing of the Jefferson County Board of Commissioners (IL) on the siting of a proposed landfill. Retained by the Opposition.
- 7 Testimony at a hearing of the Iniquois County Board of Commissioners (IL) on the siting of a proposed municipal waste in water table. Retained by the Opposition.
- 6 Testimony at a permit hearing on the land treatment of industrial wastes at the Exxon Chemical-Rollins Environmental facility in Baton Rouge, Louisiana. Retained by Exxon and Rollins.
- 5 Testimony on pond design and assessment of offsite environmental risks at the USPCI facility in Oklahoma. Retained by USPCI.
- 4 Testimony at a hearing of the Texas Railroad Commission regarding revocation of a permit for drilling mud disposal operations which had overflowed onto adjacent soil. Retained by the Opposition.
- 3 Testimony at a hearing of the Texas Water Commission regarding the land treatment of industrial wastes by Conservation Services, Inc. Retained by the Applicant.
- 2 Testimony at a hearing of the Texas Water Commission concerning the Liberty Waste Disposal Company landfill to be located near Anahuac, Texas. Retained by the Opposition.
- 1 Testimony at a hearing of the Texas Water Commission regarding a zero discharge permit for the irrigation disposal of treated sewage effluent. Retained by Upland Industries.

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LEGISLATIVE HEARING TESTIMONY

6	Testimony at a hearing of the Texas House of Representatives, Environmental Affairs Committee in April 1987, on the need for legislation to set up a waste management plan for the state.	4/87
5	Testimony at a hearing of the Texas Governor's Taskforce on Oil Spills in February 1985, on the fate of oil spill debris, and disposal technology options.	2/85
4	Testimony at a hearing of the Texas Governor's Taskforce on Hazardous Waste in November 1984, on the effectiveness of landfills for disposal technology.	11/84
3	Testimony at a hearing of the Texas Governor's Taskforce on Hazardous Waste in June 1984, on the impact of organic chemicals on the permeability of soils.	6/84
2	Testimony at a hearing of the U.S. House of Representatives, Science and Technology Committee in November 1982, on the adequacy of EPA's liquid management system to protect groundwater at hazardous waste landfills.	11/82
1	Testimony at a hearing of the Texas House of Representatives, Environmental Affairs Committee in April 1982, on the impact of organic chemicals on the permeability of clay liners.	4/82

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EXPERT WITNESS REPORT/AFFIDAVITS

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| 98 | Cause No. 3:08-CV-00229; <i>Natural Resource Defense Council, et al., Plaintiffs, v. County of Dickson, Tennessee, et al., Defendants</i> in the United States District Court for the Middle District of Tennessee. Case involved the contamination of groundwater by contaminants disposed of in the Dickson County Landfill. Expert Report. Retained by the Plaintiffs. | 8/6/10 |
| 97 | Cause No. 08-CV-0161; <i>Mary Ellen Hall, et al., Plaintiffs, v. Radiator Specialty Co., et al., Defendants</i> in the District Court of Galveston County, Texas, 212 th Judicial District. Case involved the exposure to benzene from historical emissions from the Union Carbide Chemical Co. facility in Texas City, Texas. Expert Report. Retained by the Plaintiffs. | 11/6/09 |
| 96 | Cause No. E-178,440; <i>Darla J. Lemaire, et al., Plaintiffs, v. Berryman Products, et al., Defendants</i> in the District Court of Jefferson County, Texas, 172 nd Judicial District. Case involved the exposure to benzene from on-going emissions from the Huntsman Petrochemical facility in Port Neches, Texas. Expert Report. Retained by the Plaintiffs. | 7/24/09 |
| 95 | Civil Action No. 04-C-465; <i>Virdie Allen, et al., Plaintiffs, v. Monsanto Company, et al., Defendants</i> in the Circuit Court of Putnam County, West Virginia. Case involved the contamination of communities with dioxins from the emissions from the former Monsanto facility in Nitro, West Virginia. Affidavit. Retained by the Plaintiffs. | 8/19/08 |
| 94 | Docket No. L-13345-91; <i>Pennsauken Solid Waste Management Authority, et al., Plaintiff, v. New Jersey Department of Environmental Protection, et al., Defendants</i> in the Superior Court of New Jersey, Camden County: Law Division. Case involved disposal of hazardous substances in the commercial and industrial wastes at the Pennsauken Landfill in Camden County, New Jersey and the contamination of groundwater as a result of these disposal practices. Expert Report. Retained by Third-Party Defendant Cooper Industries, Inc. | 7/18/08 |
| 93 | Cause No. GN-04-001028; <i>Sotero Carrillo, Jose Carmen Carrillo, Miguel Cruz, and Greg Fullera and A&B Construction, Inc., Plaintiffs, v. Reichold, Inc., Defendants, Zurich American Insurance Co., Intervenor.</i> In the District Court of Travis County, Texas 98 th Judicial District. Affidavit. Retained by the Plaintiffs. | 3/26/08 |
| 92 | Case No. 05-21207 Chapter 11 (Jointly Administered); In re: <i>ASARCO LLC, et al.,</i> in the United States Bankruptcy Court for the Southern District of Texas, Corpus Christi Division. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Expert Rebuttal Report. Retained by the Plaintiffs. | 2/4/08 |

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91	Case No. 05-21207 Chapter 11 (Jointly Administered); In re: <i>ASARCO LLC, et al.</i> , in the United States Bankruptcy Court for the Southern District of Texas, Corpus Christi Division. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Expert Report. Retained by the Plaintiffs.	11/15/07
90	Case No. 03-CV-498-CVE-PJC; <i>Jimmy Dale Palmer, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Affidavit. Retained by the Plaintiffs.	6/15/07
89	File No. 62-C7-05-012469; <i>State of Minnesota, Plaintiff, v. Evanston Insurance Co., et al., Defendants</i> in the District Court of Minnesota, Second Judicial District. Case involved the disposal of hazardous substances with industrial waste at the WDE Landfill and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff.	6/8/07
88	Case No. 03-CV-498-CVE-PJC; <i>Jimmy Dale Palmer, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Affidavit. Retained by the Plaintiffs.	6/4/07
87	Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved the contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Retained by the Plaintiffs.	4/2/07
86	Civil Action No. 02-CV-3830; <i>Agere Systems, Inc., et al., Plaintiffs, vs. Advanced Environmental Technology Corporation, et al., Defendant</i> , in the United States District Court for the Eastern District of Pennsylvania. This case involved the alleged disposal of hazardous wastes at the Boarhead Farms Superfund Site in Bucks County, Pennsylvania. Retained by Handy & Harman Tube Co., Defendant.	9/28/06
85	Cause No. GN-04-001028; <i>Sotero Carrillo, Jose Carmen Carrillo, Miguel Cruz, and Greg Fullera and A&B Construction, Inc., Plaintiffs, v. Reichold, Inc., Defendants, Zurich American Insurance Co., Intervenor</i> . In the District Court of Travis County, Texas 98 th Judicial District. Retained by the Plaintiffs.	8/29/06
84	Court File No. 94-CQ-57578-CM; Ontario Superior Court of Justice between: <i>Frank Augustine, et al., Plaintiffs, and INCO Limited, Defendant</i> . This case involved claims of contamination and economic loss as a result of emissions from the former nickel smelter in Port Colborne, Ontario. Expert Report. Retained by the Defendant.	5/1/06

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83	Case No. 3:98-CV-3601; <i>Cargill, Inc., et al., Plaintiffs, v. ABCO Construction, Inc., et al., Defendant</i> , in the United States District Court for the Southern District of Ohio, Western Division. This case involved claims of the disposal of hazardous substances in the former Valleycrest Landfill and the subsequent contamination of the Great Miami Aquifer. Expert Report. Retained by the Plaintiffs.	3/1/06
82	Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved claims of contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Rebuttal Report. Retained by the Plaintiffs.	2/28/06
81	Court File No. 94-CQ-57578-CM; Ontario Superior Court of Justice between: <i>Frank Augustine, et al., Plaintiffs, and INCO Limited, Defendant</i> . This case involved claims of contamination and economic loss as a result of emissions from the former nickel smelter in Port Colborne, Ontario. Expert Report. Retained by the Defendant.	2/16/06
80	Case no. 04-C-296-2; <i>Lenora Perrine, et al., Plaintiffs vs. E.I. DuPont de Nemours and Company, et al., Defendants</i> , in the Circuit Court of Harrison County, West Virginia. This case involved claims of contamination of homes and properties with metal dust from the former Meadowbrook Smelter in Spelter, West Virginia. Expert Report. Retained by the Plaintiffs.	11/11/05
79	Civil No. 95-2907 (DMC); <i>Interfaith Community Organization, et al., Plaintiffs vs. Honeywell International Inc., et al., Defendants</i> in the United States Court of Appeals for the Third Circuit. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Declaration. Retained by Honeywell, Defendant.	10/05/05
78	Cause No. L-02-0087-CV-A; <i>Betty Waldean Woelfel, et al., Plaintiffs, vs. Intercontinental Energy Corporation d/b/a IEC Corp. of Texas and Westinghouse Electric Company, L.L.C., Defendants</i> in the District Court of Live Oak County, Texas, 36 th Judicial District. Case involved the remediation and release of land associated with the Lamprecht and Zamzow ISL Uranium mine sites. Supplemental Affidavit. Retained by Defendant Viacom.	8/8/05
77	Cause No. L-02-0087-CV-A; <i>Betty Waldean Woelfel, et al., Plaintiffs, vs. Intercontinental Energy Corporation d/b/a IEC Corp. of Texas and Westinghouse Electric Company, L.L.C., Defendants</i> in the District Court of Live Oak County, Texas, 36 th Judicial District. Case involved the remediation and release of land associated with the Lamprecht and Zamzow ISL Uranium mine sites. Affidavit. Retained by Defendant Viacom.	7/29/05
76	Cause No. 02-4162 JPG; <i>Chevron Environmental Management Company, Chevron Environmental Services Company, and Texaco Inc., Plaintiffs, v. Indian Refining I Limited Partnership (f/k/a Indian Refining Limited Partnership), et al, Defendants</i> in the United States District Court for the Southern District of Illinois. Case involved remediation and allocation of costs for the former Indian refinery in Lawrenceville, IL. Affidavit. Retained by the Plaintiff	7/19/05

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75	Case No. 03-CV-327 (H) M; <i>Betty Jean Cole, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Affidavit. Retained by the Plaintiffs.	5/27/05
74	Civil Action No. 95-CV-6400L, <i>Seneca Meadows, Plaintiff vs. ECI Liquidating, et al., Defendants</i> in the United States District Court, Western District of New York. This case involved claims against defendants concerning the disposal of hazardous substances in the Tantalio Landfill, Seneca Falls, New York. Retained by the Plaintiff.	5/10/05
73	Cause No. 02-4162 JPG; <i>Chevron Environmental Management Company, Chevron Environmental Services Company, and Texaco Inc., Plaintiffs, v. Indian Refining I Limited Partnership (f/k/a Indian Refining Limited Partnership), et al, Defendants</i> in the United States District Court for the Southern District of Illinois. Case involved remediation and allocation of costs for the former Indian refinery in Lawrenceville, IL. Retained by the Plaintiff	5/2/05
72	File No. C7-0310992; <i>State of Minnesota, Plaintiff, v. American Hardware Mutual Insurance Company, Defendants</i> in the District Court of Minnesota, Tenth Judicial District. Case involved the disposal of hazardous substances with industrial waste at Oak Grove and East Bethel Landfills and the contamination of groundwater as a result of these disposal practices. Retained by the Plaintiff.	4/11/05
71	Cause No. C200300273 <i>Judy Miller, Stan Miller, Deanna Aureli, Brent Aureli, and Nicholas Aureli v Blue Haven Pool, Defendant</i> in the Texas Judicial Court of Johnson County. Case involved claims against the defendant regarding the installation of a swimming pool, and a broken septic sewer line. Retained by the Defendant.	11/22/04
70	Case No. 03-CV-327 (H) M; <i>Betty Jean Cole, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Expert Rebuttal Report. Retained by the Plaintiffs.	10/28/04
69	Nos. 03-2760, 03-3037 & 03-3585; <i>Interfaith Community Organization, et al., Plaintiffs vs. Honeywell International Inc., et al., Defendants</i> in the United States Court of Appeals for the Third Circuit. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Affidavit. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants.	6/25/04

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| 68 | Civil Action No. 01:01-CV-890; <i>Lyondell Chemical Company, et al., Plaintiffs v. Albemarle Corporation, et al., Defendants</i> in the United States District Court for the Eastern District Of Texas Beaumont Division. This case involved the disposal of waste containing hazardous substances and groundwater contamination at the Turtle Bayou Superfund in Liberty County, Texas. Supplemental Report. Retained by ExxonMobil, Defendant. | 5/14/04 |
| 67 | Case No. 94 CV 012385; <i>Employers Insurance of Wausau, A Mutual Company, Plaintiffs, v. Newell Co., Defendants</i> in the State of Wisconsin Circuit Court for Milwaukee County. Case involved characterization of waste streams and the hazardous constituent content of waste streams produced by the Newell Co. subsidiaries, as well as the disposal of hazardous constituents into municipal landfills by the Newell Co. subsidiaries. Expert Report. Retained by the Defendants. | 5/3/04 |
| 66 | Cause No. 03-001121-CV; <i>Joseph Paul Horlen, et al., Plaintiffs, v. Robert S. Smith and Robo Investments, Inc., Defendants</i> in the District Court of Brazos County, Texas, 361 st Judicial District. Case involved the subsurface loss of water from a man-made lake within a residential subdivision and the subsequent undercutting of riverbank along the Brazos River. Affidavit. Retained by the Plaintiffs. | 4/29/04 |
| 65 | Case No. 03-CV-327 (H) M; <i>Betty Jean Cole, et al., Plaintiffs, v. Asarco Incorporated, et al., Defendants</i> in the United States District Court for the Northern District of Oklahoma. Case involved an evaluation of the Tar Creek Superfund site and the subsequent assessment and evaluation of lead contamination and lead transport pathways in the communities of Picher and Cardin, Oklahoma, including the impacts of lead exposure to the children within these communities. Expert Report. Retained by the Plaintiffs. | 4/12/04 |
| 64 | Cause No. 03-001121-CV; <i>Joseph Paul Horlen, et al., Plaintiffs, v. Robert S. Smith and Robo Investments, Inc., Defendants</i> in the District Court of Brazos County, Texas, 361 st Judicial District. Case involved the subsurface loss of water from a man-made lake within a residential subdivision and the subsequent undercutting of riverbank along the Brazos River. Expert Opinion. Retained by the Plaintiffs. | 3/5/04 |
| 63 | Docket No. CWA-06-2003-4805; <i>BP Pipelines (North America) Inc., Respondent, v. United States Environmental Protection Agency Region 6.</i> Case involved the subsurface release of crude oil from a pipeline at a site near Mertzon, Texas. Declaration. Retained by the Respondent. | 2/6/04 |
| 62 | Civil Action No. 95-2097; <i>Interfaith Community Organization, et al., vs. Honeywell International Inc., et al.,</i> in the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Affidavit. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants. | 1/9/04 |

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| 61 | Civil Action No. 01:01-CV-890; <i>Lyondell Chemical Company, et al., Plaintiffs v. Albemarle Corporation, et al., Defendants</i> in the United States District Court for the Eastern District Of Texas Beaumont Division. This case involved the disposal of waste containing hazardous substances and groundwater contamination at the Turtle Bayou Superfund in Liberty County, Texas. Expert Witness Report. Retained by ExxonMobil, Defendant. | 12/19/03 |
| 60 | File No. CT 02-016741; <i>State of Minnesota, by its Attorney General, Mike Hatch, Plaintiff, v. American Hardware Mutual Insurance Company, et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the breach of the asphalt seal in the Hazardous Waste Disposal Pit at the Waste Disposal Engineering Landfill in Anoka County contributed to the groundwater contamination in the vicinity of the site. Affidavit. Retained by the Plaintiff. | 12/19/03 |
| 59 | Civil Action No. 95-2097; <i>Interfaith Community Organization, et al., vs. Honeywell International Inc., et al.</i> , in the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Affidavit. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants. | 12/3/03 |
| 58 | Docket No. CWA-06-2003-4805; <i>BP Pipelines (North America) Inc., Respondent, v. United States Environmental Protection Agency Region 6</i> . Case involved the subsurface release of crude oil from a pipeline at a site near Mertzon, Texas. Expert Witness Report. Retained by the Respondent. | 11/21/03 |
| 57 | Civil Action No. 95-2097; <i>Interfaith Community Organization, et al., Plaintiffs vs. Honeywell International Inc., et al., Defendants</i> in the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Declaration. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants. | 11/13/03 |
| 56 | Civil Action No. 95-CV-6400L; <i>Seneca Meadows, Inc., et al., Plaintiffs, v. ECI Liquidating, Inc., et al., Defendants</i> in The United States District Court Western District Of New York. Case involved the disposal of industrial and domestic waste at the Tantalo Landfill in Seneca County. Expert Witness Report. Retained by the Plaintiff. | 10/17/03 |
| 55 | Civil Action No. 98-CV-0838S (F); <i>W.R. Grace & Co.-Conn., Plaintiff, V. Zotos International, Inc., Defendant</i> in the United States District Court Western District Of New York. Case involved the disposal of cosmetic waste at the Brewer Road Landfill in Waterloo County, and the contamination of groundwater as a result of these disposal practices. Declaration. Retained by the Plaintiff. | 9/29/03 |
| 54 | Court File No. MC00-001819; <i>State of Minnesota, by its Attorney General, Mike Hatch, Plaintiff, v. Employers Insurance of Wausau, A Mutual Company, et al., Defendants</i> in the District Court of Minnesota, Fourth Judicial District. Case involved the disposal of hazardous substances with industrial waste at the Oak Grove Landfill and East Bethel Landfill in Anoka County, and the contamination of groundwater as a result of these disposal practices. Affidavit. Retained by the Plaintiff. | 2/5/03 |

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| 53 | Case No. 00-01917 MRP (MANx); <i>Shell Chemical Co., et al., Plaintiffs, vs. The County of Los Angeles, et al., Defendants</i> in the United States District Court for the Central District of California; Case No. 00-1938 MRP (MANx); <i>Phillips Petroleum Co., et al., Plaintiffs, vs. The County of Los Angeles, et al., Defendants</i> in the United States District Court for the Central District of California; and Case No. 00-6420 MRP (MANx); <i>Atlantic Richfield Co., et al., Plaintiffs, vs. BKK Corporation, et al., Defendants</i> in the United States District Court for the Central District of California. These combined cases involved hazardous substances associated with municipal solid waste being deposited at Cal Compact Landfill. Expert Witness Report. Retained by the Plaintiffs. | 1/13/03 |
| 52 | Cause No. 98-56362; <i>Browning-Ferris Industries, Inc., et al., Plaintiffs, v. Certain Underwriters at Lloyd's London, et al., Defendants</i> in the 80 th Judicial District, District Court of Harris County, Texas. This case involved the disposal of waste containing hazardous substances and groundwater contamination at the Renner Landfill in Beaumont, Texas. Expert Witness Report. Retained by the Defendants. | 1/03/03 |
| 51 | Case No. 80-1589; <i>United States of America, Plaintiff, vs. City of Philadelphia, Plaintiff-Intervenor, vs. Union Corporation Metal Bank of America, et al., Defendants, vs. Consolidated Edison Company of New York, et al., Third Party Defendants</i> in the United States District Court for the Eastern District of Pennsylvania. This case involved claims against the defendants concerning the release of PCBs from the Metal Bank/Cottman Avenue Site to the Delaware River. Rebuttal Report. Retained by the Defendants. | 8/23/02 |
| 50 | Civil Action No. 98-CV-0696A (F); <i>Booth Oil Site Administrative Group, Plaintiffs, vs. Safety-Kleen Corp., et al., Defendants</i> , in the United States District Court for the Western District of New York. This case involved claims against the defendants concerning the release of contaminants during used oil-recycling operations at the Booth Oil facility in North Tonawanda, New York. Affidavit. Retained by the Plaintiffs. | 5/02/02 |
| 49 | Case No. 80-1589; <i>United States of America, Plaintiff, vs. City of Philadelphia, Plaintiff-Intervenor, vs. Union Corporation Metal Bank of America, et al., Defendants, vs. Consolidated Edison Company of New York, et al., Third Party Defendants</i> in the United States District Court for the Eastern District of Pennsylvania. This case involved claims against the defendants concerning the release of PCBs from the Metal Bank/Cottman Avenue Site to the Delaware River. Expert Witness Report. Retained by the Defendants. | 8/23/01 |
| 48 | Civil Action No. 1999-48287; <i>Tim Dyring et al., Plaintiffs, v. Rohm & Haas Texas, Inc., et al., Defendants</i> in the 125 th District Court of Texas. This case involved claims against the defendants concerning the release of hazardous substances to the groundwater from waste materials disposed at the Charley Burch Site in South Montgomery County, Texas. Expert Witness Report. Retained by the Plaintiffs. | 5/31/01 |
| 47 | Civil Action No. 95-2097; <i>Interfaith Community Organization, et al., vs. Honeywell International Inc., et al.</i> , in the United States District Court for the District of New Jersey. This case involved claims against the defendants concerning disposal of chromium waste at the Roosevelt Drive-In Site in Jersey City, New Jersey. Expert Witness Report. Retained by W.R. Grace & Co., W.R. Grace Ltd. and ECARG, Inc., Defendants. | 3/27/01 |

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46	Civil Action No. G-96-493; <i>Janie Rivas, et al., vs. Monsanto Company, et al.</i> , in the United States District Court for the Southern District of Texas Galveston Division. This case involves modeling of emissions and air dispersion of hazardous substances emanating from petrochemical wastes processed and disposed of at the Brio/Dixie Oil Processors Superfund Sites in Houston, Texas and related exposures to children in adjacent neighborhoods. Expert Witness Report. Retained by the Plaintiffs.	3/2/01
45	Civil Action No. 5:97 CV00894; <i>United States of America vs. Chrysler Corporation, et al.</i> , in the United States District Court for the Northern District Of Ohio. This case involved claims against the defendants concerning disposal of hazardous substances in the Krejci Dump Site. Expert Witness Report. Retained by Minnesota Mining & Manufacturing Co., Defendant.	2/28/01
44	Civil Action No. H-98-0408 <i>United States of America, et al vs. Atlantic Richfield Company, et al vs. Ashland, Inc., et al.</i> , in the United States District Court Southern District of Texas Houston Division. This case involved claims against defendants concerning waste disposal at Sikes Pit. Expert Witness Report. Retained by ExxonMobil, Defendant.	2/15/01
43	Case No. 98-CV0726 <i>Connie Lolley Klostermann, et al vs. Ultramar Diamond Shamrock Corporation, et al.</i> , in the 212 th Judicial District Court, Galveston County, Texas. This case involved a lawsuit by the landowner concerning property damage resulting from leaking storage tank contamination. Retained by Diamond Shamrock, Defendant.	5/19/00
42	Case No. 97-6222 MRP (MANx) <i>Commercial Realty Projects, Inc., and L.A. Metromall LLC, vs. Atlantic Richfield Company, et al.</i> , in the United States District Court in for the Central District of California. This case involved hazardous substances associated with municipal solid waste being deposited at Cal Compact Landfill. Retained by the Defendants.	5/8/00
41	Civil Action No. 95-CV-6400L, <i>Seneca Meadows vs. ECI Liquidating, et al.</i> This case involved claims against defendants concerning the disposal of hazardous substances in the Tantalo Landfill, Seneca Falls, New York. Retained by the Plaintiff.	4/18/00
40	Case No. 92-034865; <i>James E. Barnet, Sr., et al., vs. Monsanto Company, et al.</i> In the District Court of Harris County, Texas, 80 th District Court. This case involved former workers' claims concerning exposure to hazardous chemicals. Retained by the Plaintiffs.	4/7/00
39	Case No. 97-6222 MRP (MANx) <i>Commercial Realty Projects, Inc., and L.A. Metromall LLC, vs. Atlantic Richfield Company, et al.</i> , in the United States District Court in for the Central District of California. This case involved hazardous substances associated with municipal solid waste being deposited at Cal Compact Landfill. Retained by the Defendant.	2/25/00
38	Civil Action No. 89-4340(JBS); <i>The United States v. Helen Kramer</i> ; United States District Court District of New Jersey. This case involved claims against a defendant concerning the disposal of hazardous substances in the Kramer Landfill (Superfund Site). Retained by the Plaintiffs.	6/99

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37	Civil Action No. G-96-494; <i>Thu Van Le, et al., v. Monsanto Co., et al.; Defendant.</i> In the United States District Court for the Southern District of Texas Galveston Division. This case involved modeling of emissions and air dispersion of hazardous substances emanating from petrochemical wastes processed and disposed of at the Brio/Dixie Oil Processors Superfund Sites in Houston, Texas and related exposures to children in adjacent neighborhoods. Retained by the Plaintiffs	2/5/99
36	Civil Action No. G-96-493; <i>Janie Rivas, et al., vs. Monsanto Company, et al.; Defendant.</i> In the United States District Court for the Southern district of Texas Galveston Division. This case involved modeling of emissions and air dispersion of hazardous substances emanating from petrochemical wastes processed and disposed of at the Brio/Dixie Oil Processors Superfund Sites in Houston, Texas and related exposures to children in adjacent neighborhoods. Retained by the Plaintiffs.	2/5/99
35	Civil Action No. 95-2215; <i>Becton Dickinson Puerto Rico, Inc., et al., vs. Cheeseborough Pond's Manufacturing Company, et al.;</i> United States District Court For the District of Puerto Rico. This case involved claims against the defendant concerning the disposal of hazardous substances in the Juncos Landfill (Superfund Site). Retained by the Plaintiffs.	1/19/99 3/3/97 11/14/96
34	Case No. 95C-1065; <i>Lemberger Sites Remediation Group, Plaintiff, v. A.M. Richter & Sons Co., et al., and White Consolidated Industries, Inc., Defendants;</i> In the United States District Court Eastern District of Wisconsin. This case involved hazardous constituents in waste going to Lemberger Landfill (Superfund Site). Retained by the Plaintiff.	11/12/98
33	Case No. 98-459-A, <i>Lewie Byers, vs. Texaco Exploration and Production Inc. and Texaco, Inc.;</i> In the District Court of Smith County, Texas 7 th Judicial District. This case involves claims of contamination due to releases of crude oil and fluids from oil field production activities. Retained by the Defendant.	4/30/99 2/29/99 1/29/99
32	Case No. 96-72483; <i>Minnesota Mining and Manufacturing (3M) Company, Plaintiff v. Howard W. Stein, Jr., Stein Enterprises, Inc. (f/k/a Stein's Flower Shop and Green Houses, Inc.), the Dow Chemical Company, and General Motors Corporation, Defendants.</i> In the United States District Court for the District of Michigan, Southern Division. Case involved evaluation of waste disposed at the Michigan Avenue Dumpsite by General Motors Corporation and Dow Chemical Company. Retained by the Plaintiff, 3M.	6/31/98 6/15/98
31	Case 75524; <i>Clarice Friloux, et al., Plaintiffs, vs. Campbell Wells Corporation, et. al., Defendants.</i> In the 17 th Judicial District Court, Parish of Lafourche, Louisiana. Case involved claims of offsite air migration of hazardous substances purportedly associated with a non-hazardous oilfield waste disposal facility. Retained by the Defendants.	5/4/98 1/6/98
30	Court File No. 3-95-933. <i>Onan Corporation, Plaintiff and the State of Minnesota, and by its Attorney General, Hubert H. Humphrey, III, and by It Pollution Control Agency, Intervenor, v. Continental Insurance Company, Defendant.</i> In the United States District Court, District of Minnesota. Case involved time of Leachate travel through two Landfills in Minnesota, Oak Grove Landfill and WDE Landfill, and the impact of the Leachate on the groundwater. For the Intervenor.	6/18/97

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| 29 | Civil Action No. 95-514875-CE; <i>Grand Trunk Western Railroad, Incorporated and Star Oil Company, Inc., Plaintiffs vs. Union Oil Company of California, Wynkoop Oil Company, Clement Wynkoop, Secory Oil Company and Lewis Secory, Defendants and Union Oil Company and Clement Wynkoop, Counter-Plaintiffs/Cross-Plaintiffs vs. Secory Oil Company and Lewis Secory.</i> Case involved modeling of the transport and fate of hydrocarbon fuels, which leaked from storage, tanks at a terminal and allegedly migrated onto adjoining properties of plaintiffs. Retained by the Defendants. | 5/22/97 and
6/2/97 to
6/3/97 |
| 28 | Civil Action No. 96-C-00489-5; <i>Junker Landfill Trust, Plaintiff vs. United Waste Systems, Inc. et al., Defendants, and Junker Recycling, Inc., et. al., Defendants and Third Party Plaintiffs, vs. Garry Thompson, et al., Third Party Defendants;</i> and Civil Action No. 96-C-00489-5, <i>Landfill Remediation Trust, Plaintiff vs. Garry Thompson, et al., Defendants.</i> In the United States District Court for the Western District of Wisconsin. Case involved contamination of groundwater, surface water, soil gas, and soil at the Junker Landfill (Superfund Site) and the relationship of that contamination to the wastes from over 450 generators. Retained by Plaintiffs. | 2/20/97 and
2/25/97 |
| 27 | Case No. 61180; <i>Kenneth and Helen Songer, Plaintiffs vs. Billy and Mary Clement d/b/a Cecle Clement & Sons, and Harrison, Walker, Harper, Inc. and Joe Archer, d/b/a Archer Excavating.</i> In the District Court of Lamar County, Texas, 6 th Judicial District. Case involved claims of air contamination (hazardous gases and particulates) from trucking and excavating operations. Retained by the Defendants. | 7/1/97 and
10/31/97 |
| 26 | Case No. 93-C-0314; <i>Hunt's Generator Committee, et al., Plaintiffs v. Allis Chalmers Corporation, et al., Defendants.</i> In the United States District Court for the Eastern District of Wisconsin. Case involved identification of waste products and hazardous substances within those waste products, which were disposed at the Hunt's Disposal Landfill Site near Caledonia, Wisconsin. Retained by Plaintiff PRP Group. | 4/14/97 |
| 25 | Civil Action No. 94-1449-A; <i>Ardith Cavallo, Plaintiff vs. Star Enterprise, Texaco Refining & Marketing (East), Inc., and Saudi Refining, Inc., Defendants.</i> In the United States District Court, District of Eastern, Virginia. Case involved claim of property damage from hydrocarbons in the groundwater, which allegedly migrated to plaintiff's property from a fuel terminal in Fairfax, Virginia. Retained by the Defendants. | 3/6/97 |
| 24 | Case No. 93-004644; <i>Mike Adalis, et. al., Plaintiffs, vs. Neighborhood Development Corporation, et. al., Defendants.</i> In the District Court of Harris County, Texas, 269 th Judicial District. Case involved claims of groundwater and related drinking water well contamination attributable to 50 year old oil well blowout. Retained by the defendant Exxon. | 12/16/96 |
| 23 | Case No. 2:92-CV-111; <i>Commercial Union Insurance Co., et al. v. Cannelton Industries, Inc.,</i> In the United States District Court for the Western District of Michigan. Case involved claim against insurance company for environmental remediation cost recovery associated with chromium contamination of St. Mary's River due to a fire at an old tannery plant. Retained by Defendant. | 9/5/96 |

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22	Case No. 93-C-0324; <i>Hunt's Generator Committee, et al. v. Allis Chalmers Corporation, et al.</i> ; In the United States District Court, Eastern District of Wisconsin. Case involved identification of hazardous constituents in common household products found in the municipal solid waste from one city and disposed at the Hunt's Disposal Landfill Superfund Site at Caledonia, Wisconsin. Retained by Plaintiff PRP Group.	8/21/96
21	Civil Action No. H-95-776; <i>Rodney and Brenda Kay Beaver A/N/F of Wesley Michael Beaver and Claude Paul Hargraves v. Monsanto Company</i> ; In the United States District Court for the Southern District of Texas, Houston Division. Cause involved short-term exposure of children to toxic contaminants in air, soil, and drinking water at athletic facility located adjacent to waste disposal/processing sites (Dixie Oil Processors/Brio Superfund Sites). Retained by the Plaintiffs.	5/24/96
20	Civil No. BC015575; <i>Atlantic Richfield Co. and ARCO Chemical Co., v. Aetna Casualty and Surety Co. of American</i> . Superior Court of the State of California. A Declaration on behalf of ARCO Garber, ARCO Sand Springs, and ARCO Prewitt.	10/17/95
19	Civil Action No. 87-4263(JHR); <i>General Electric Company v. Buzby Brothers Materials Handling Company, et al.</i> United States District Court for the District of New Jersey. Case involved recovery from commercial and municipal transporters of wastes of the costs for remediation of groundwater contamination at the site of the RCA-Buzby Landfill (Superfund Site) near Voorhees, New Jersey. Retained by the Plaintiff.	9/28/95
18	Case No. 4-93-CV-193; <i>Cooper Industries, Inc., v. Abbott Laboratories, et al., in the U. S. District Court for the Western District of Michigan</i> . Case involving Sturgis (Michigan) Well Field Superfund Site and the apportionment of remediation costs as between plaintiff and 35 defendants for solvent contamination of groundwater. Retained by the Plaintiffs.	8/14/95
17	Civil Action No. 94-C-1025; <i>The City and County of Denver, et. al., v. Alumet Partnership, et al., and Alumet Partnership, et al., v. City of Aurora</i> . U.S. District Court for the District of Colorado. Retained by the Defendants.	5/31/95
16	Civil Action No. 94-1449-A; <i>Ardith Cavallo v. Star Enterprise, Texaco Refining & Marketing (East), Inc., and Saudi Refining, Inc.</i> United States District Court, District of Eastern Virginia. Expert Witness Report. Retained by the Defendants.	4/24/95
15	Civil Action No. 93-CV-0080-B; <i>KN Energy, Inc. et al., v. Sinclair Oil Corporation d/b/a Little America Refining Company</i> . United States District Court, District of Wyoming. Expert Witness Report. Retained by the Plaintiff.	2/15/95
14	Docket Nos. BUR-L-2533-92/01267-93; <i>Gouryeb v. Woodland Township Planning Board</i> , Superior Court of New Jersey, Law Division/Burlington County. Affidavit. Retained by the Plaintiff.	12/1/94
13	Consolidated Civil Actions No. 90-75 BU-PGH; <i>ARCO v. Oaas, et al.</i> , and No. 91-82-BU-PGH, <i>United States v. Montana Pole and Treating Plant, et al.</i> United States District Court for the District of Montana, Butte Division. Expert Witness Report. Retained by the Defendant/Third Party Plaintiff.	8/15/94 9/12/94

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12	Civil Action No. 94-243-A; <i>William H. Ogden and Gay E. Tiffany v. Star Enterprise, et al.</i> United States District Court for the Eastern District of Virginia, Alexandria Division. Declaration. Retained by the Defendants.	8/31/94
11	Civil No. 93-186; <i>United States v. Somerset Refinery, Inc.</i> United States District Court for the Eastern District of Kentucky. Expert Witness Report. Retained by the U.S. Department of Justice.	8/26/94
10	Civil No. 93-381-A; <i>Brian Feikema et al., v. Texaco, Inc., et al.</i> United States District Court for the Eastern District of Virginia. Declaration. Retained by the Defendants.	7/14/94 6/29/94
9	Docket No. N-93-39-BU-PGH; <i>Montana Resources Inc., et al., v. Atlantic Richfield Co.</i> U.S. District Court for the District of Montana. Retained by the Defendant.	6/14/94
8	Case No. 89-135; <i>Citizens Asking For a Safe Environment, Inc., et al., v. South Carolina Department of Health and Environmental Control, et al.</i> In the Matter of the RCRA Permit Decision for GSX Services of SC, Inc. Pinewood Facility, Sumter County; SC, before the State of South Carolina Board of Health and Environmental Control. Retained by the Opposition.	3/94
7	File No. 3-90-312; <i>Kenneth M. Anderson as Personal Representative of the Estate of Fred W. Hedberg v. City of Minnetonka et al.</i> United States District Court for the District of Minnesota, Third Division. Affidavit. Retained by the Plaintiff.	12/18/92
6	Affidavit and rebuttal affidavit regarding the proposed Lon C. Hill-Coletto Creek 345 kV transmission line. Retained by Central Power & Light.	10/21/91 8/90
5	File No. 3-90-312; <i>Kenneth M. Anderson as Personal Representative of the Estate of Fred W. Hedberg v. City of Minnetonka et al.</i> United States District Court for the District of Minnesota, Third Division. Retained by the Plaintiff.	7/16/91
4	Civil Action No. N-87-52 (both cases); <i>The B. F. Goodrich Company, et. al., v. Harold Murtha, et al., and Harold Murtha, et al., v. Risdon Corporation.</i> Circuit Court for the State of Connecticut. Contribution of municipal waste to environmental contamination associated with the Beacon Heights and Laurel Park Landfills (Superfund Sites). Retained by the Laurel Park and the Beacon Heights Coalitions.	6/29/90
3	Cause No. C88-0190-B consolidated with C89-0153-B; <i>Sinclair Oil Corporation v. James S. Scherer, et al., and United States of America v. Sinclair Oil Corporation.</i> United States District Court for the District of Wyoming. Suit concerning alleged contamination from refinery operations. Retained by the United States.	4/27/90
2	Case No. 80-4-CIV-7; <i>The United States of America v. Waste Industries, Inc., et al.</i> United States District Court for the Eastern District of North Carolina, Wilmington Division. Affidavit on leaking municipal landfill. Retained by the Plaintiff.	9/29/85
1	Affidavit and rebuttal affidavit regarding the proposed expansion of the Azusa Landfill (CA). Retained by an <i>amicus curae</i> party.	

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MEDIATION PRESENTATIONS AND ENVIRONMENTAL REPORTS

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| 3 | Report of “An Investigation and Assessment of the Texaco Sand Flat Unit,” by Dr. Kirk W. Brown. Prepared for Wallace, King, Marraro, and Branson, LLC on behalf of Texaco Exploration and Production. | 11/13/98 |
| 2 | Report of “Evidence of Leachate Leaking from Azusa Landfill,” by Dr. Kirk W. Brown. Prepared for Geoscience Support Services, Inc. for Metropolitan Water District of California. | |
| 1 | Cause No. 93-1235; <i>Adams, et al., v. RSR Corporation, et al.</i> 71 st Judicial District Court; Harrison County, Texas. Retained by the Plaintiffs. | 12/14/94 |

APPENDIX 3

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